To: Wysong, Sheri[swysong@blm.gov]
Cc: Lola Bird[lbird@blm.gov]; Edwin Roberson[eroberso@blm.gov]; Anita Bilbao[abilbao@blm.gov]; Aaron Curtis[acurtis@blm.gov]; Ashcroft, Tyler[tashcrof@blm.gov]; Kent Hoffman[khoffman@blm.gov]; Kerry Schwartz[kschwartz@blm.gov]; Ashley Losey[alosey@blm.gov]; Thomas, Nathan[nthomas@blm.gov]; Shauna Derbyshire[sderbyshire@blm.gov]; Laurie Ford[lford@blm.gov]; Roger Bankert[rbankert@blm.gov]; Wilcken, Leslie[lwilcken@blm.gov]; Joshua Robbins[jcrobbin@blm.gov]; Staszak, Cynthia[cstaszak@blm.gov]; Matthew Betenson[mbetenso@blm.gov]; Naeve, Robin[rnaeve@blm.gov]; Stanley Perkes[sperkes@blm.gov]; Larry Garahana[lgarahan@blm.gov]; mcoultha@blm.gov[mcoultha@blm.gov]
From: Ginn, Allison
Sent: 2017-05-17T10:01:28-04:00
Importance: Normal
Subject: Re: 5/16 Afternoon Draft of GSENM Data Call Responses
Received: 2017-05-17T10:01:42-04:00
2017 Exchange Tract memo.pdf
GSENM Coal Lease Cancellation Payments.pdf
MOU_SITLA-BLM-FS Land Excange Pub Law No 105-335 Stat 3139_ratified 8 May 1998.pdf
Upper Valley Field Map.pdf
Upper Valley GSE Production.pdf
Upper Valley Wells in GSENM.xlsx
UGS Circular 93 GS Energy and Mineral Resources.pdf
SITLA_FY2013_Annual_Report_Email.pdf
FINAL EIS - Dev of Coal Resources in_Southern Utah Part 1 Regional.pdf
A Bedingfield to J McKenzie 16 May 2017.pdf
Minerals_Energy_OandGdata_GSENM.docx

Attached are the files we received from 5th floor last night (compiled response is in Minerals_Energy_OandGdata_GSENM.docx) for GSENM.

Regards,

Allison Ginn
National Conservation Lands Program Lead
BLM Utah State Office
801-539-4053

On Tue, May 16, 2017 at 5:38 PM, Wysong, Sheri <swysong@blm.gov> wrote:

> Here is the Bear's Ears with oil and gas info.

On Tue, May 16, 2017 at 2:10 PM, Ginn, Allison <aginn@blm.gov> wrote:

> UTSO Team-
>
> Please find attached update Word versions of the Executive Summary and Data Responses for Grand Staircase National Monument and the supporting documents. (Seriously, their staff is amazing- the breadth of materials collected in such short order is phenomenal.) GSENM is still working diligently on this response, so please be advised that this is just an updated draft and subject to changes.
>
> All supporting documents are located in the DOI's Google Drive folder, but only a few BLMers have access in Drive. Because there are many large files, I'm attaching only a few documents referenced in the response that I think will be of interest to UTSO reviewers.
>
> I believe that Cindy is still waiting on some information from the 5th floor, the grazing program, and review by

External Affairs.

I've been at my desk since 5:45 am and am heading home shortly, but wanted UTSO staff members to have an opportunity to see the progress of the document. Please bring any issues to our attention during the conference call tomorrow morning (UTSO folks can gather in Monument Room A).

Thanks!

Regards,

Allison Ginn
National Conservation Lands Program Lead
BLM Utah State Office
801-539-4053

--

Sheri Wysong
Fluid Minerals Leasing Coordinator
Utah State Office, Bureau of Land Management
801-539-4067

McKenzie, Jefferson <jmckenzi@blm.gov>

Re: Exchange tract memo

1 message

Andy Bedingfield <abedingfield@utah.gov> Tue, May 16, 2017 at 11:46 AM
To: "McKenzie, Jefferson" <jmckenzi@blm.gov>

Our accounting office computes that $57,233,712.32 has been paid to the School Fund from the EGSNM Exchange Tracts. This amount does not include moneys paid to the State of Utah or bonuses paid to the federal government.

On Tue, May 16, 2017 at 10:24 AM, McKenzie, Jefferson <jmckenzi@blm.gov> wrote:

> Thanks...!
>
> On Tue, May 16, 2017 at 10:00 AM, Andy Bedingfield <abedingfield@utah.gov> wrote:
>
> > See attached.
> >
> > --
> > Andy Bedingfield, PE
> > Utah School Trust Lands
> > 675 East 500 South, Suite 500
> > Salt Lake City, UT 84102-2818
> > (801) 538-5158
>
> --
> JD McKenzie
> Coal Mining Engineer
> 801-539-4038
> jmckenzi@BLM.gov
> 440 West 200 South, Suite 500
> Salt Lake City, Utah 84101
>
> Confidential Notice: This electronic communication is intended only for the use of the individual(s) or entity(ies) to which it is addressed and may contain information that is privileged, confidential and exempt from disclosure under applicable law. If you have received this communication in error, please do not distribute, delete the original message, and notify the sender.

--
Andy Bedingfield, PE
Utah School Trust Lands
675 East 500 South, Suite 500
Salt Lake City, UT 84102-2818
(801) 538-5158

State of Utah
School & Institutional
Trust Lands Administration

675 East 500 South, Suite 500
Salt Lake City, UT 84102-2813
801-538-5100
801-355-0922 (Fax)
www.trustlands.utah.gov

Gary R. Herbert
Governor

Spencer J. Cox
Lieutenant Governor

David Ure
Director

February 8, 2017

MEMORANDUM

TO: Roger Bankert, Minerals Branch Chief
Bureau of Land Management, Utah State Office
440 West 200 South, Suite 500
Salt Lake City, UT 84101

FROM: Andy Bedingfield

SUBJECT: Annual Report of Coal Tonnage Status on 1998 Exchange Tracts

In accordance with paragraph IC.3.c of the *Memorandum of Understanding* I am reporting to BLM the cumulative coal tonnage produced (i.e. mined and sold) as of December 31, 2016, from the following 1998-Utah Schools and Federal Land Exchange Act (PL105-335) coal tracts.

TRACT NAME	SITLA LEASE #	SITLA TONS OWNED	CUMULATIVE SITLA TONS PRODUCED
Mill Fork	ML 48258	22.3 Million	22.3 Million (Reverted 7/12)
Combined Dugout Canyon/Muddy		34 Million	26,313,,296.04
(Dugout Canyon	ML 48435		12,421,137.04, Mined Out)
(Muddy	ML 49443		13,892,159.00)
North Horn	Unleased	100,000,000	-0-

Cottonwood Tract: The Utah School and Institutional Trust Lands ("SITLA") own a rental/royalty value rather than a fixed coal tonnage in the Cottonwood coal tract. An 8,203.87 acre parcel of the coal tract was leased at the beginning of 2008 under mineral lease number ML 51191-OBA. The lease is not yet in production, but is paying annual rental and annual minimum royalty. The remaining net total Dollar value owned by SITLA in the Cottonwood coal tract as of December 31, 2016, was $17,364,300.64 (i.e., principal plus accumulated interest, reduced by 50% of annual rental and minimum royalty payments.) The payment due date of the lease is January 18, each year, at which time the balance on the SITLA account may be further reduced.

Please contact me at (801) 538-5158 if you have any questions in this matter.

The Salt Lake Tribune Utah's Independent Voice Since 1871

U.S. Government Buys Coal Leases in National Monument

Saturday, October 16, 1999

BY JIM WOOLF
THE SALT LAKE TRIBUNE

The U.S. Department of Interior agreed Friday to pay $5.5 million for PacifiCorp's federal coal leases in the Grand Staircase-Escalante National Monument in southern Utah.

This is the second major coal agreement in just one week. On Oct. 8 the agency negotiated a $14-million payment for adjacent federal coal leases owned by Sandy-based Andalex Resources.

Development of both sets of leases was blocked in 1996 by President Clinton's surprise decision to create the 1.9-million-acre monument. The president used the threat of Andalex's proposed coal mine about 70 miles east of Kanab as one of his reasons for protecting the area.

For the three years since the monument's creation, Andalex and PacifiCorp have been negotiating a deal that would compensate them for the coal losses. This involved appraisals and estimates of the likelihood that coal from this remote region would be developed profitably sometime in the near future.

"From PacifiCorp's point of view, those leases had a substantially higher value than $5.5 million," said company spokesman Dave Eskelsen. "But this agreement was a way to conclude the process and move on."

— $300/acre

Officials from Andalex and the Department of Interior never could agree on the value of those leases, so the $14-million payment was based on the amount the company had spent developing its mine plan.

— $405/acre

The Andalex and PacifiCorp deals are subject to approval by Congress.

PacifiCorp, the Portland-based parent company of Utah Power, held 18,287 acres of coal leases within the monument. Andalex had 34,499 acres of leases.

Interior Secretary Bruce Babbitt praised the PacifiCorp decision, saying in a prepared statement: "This is another follow-through by the administration on President Clinton's proclamation of the Grand Staircase-Escalante National Monument."

DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
CASE RECORDATION
(MASS) Serial Register Page

01 10-21-1976;090STAT2755;43USC1715
Case Type 210013: ACQ-FLPMA
Commodity 001: NONE
Case Disposition: AUTHORIZED

Total Acres
34,498.730

Serial Number
UTU--- - 078759

Serial Number: UTU--- - 078759

Name & Address				Int Rel	% Interest
AMCA COAL LEASING	BOX 902	PRICE UT 84501		LESSEE	0.000000000
BLM	BOX 45155	SALT LAKE CITY UT 841450155		ACQUIRING AGENCY	100.000000000

Serial Number: UTU--- - 078759

Mer Twp Rng Sec	STyp SNr Suff	Subdivision	District/Resource Area	County	Mgmt Agency
26 0410S 0030E 001	ALL	ENTIRE SECTION	GRAND STAIRCASE-ESCALANTE	KANE	BUREAU OF LAND MGMT
26 0400S 0040E 005	ALL	ENTIRE SECTION	GRAND STAIRCASE-ESCALANTE	KANE	BUREAU OF LAND MGMT
26 0400S 0040E 006	ALL	ENTIRE SECTION	GRAND STAIRCASE-ESCALANTE	KANE	BUREAU OF LAND MGMT
26 0400S 0040E 031	ALL	ENTIRE SECTION	GRAND STAIRCASE-ESCALANTE	KANE	BUREAU OF LAND MGMT
26 0410S 0040E 007	ALL	ENTIRE SECTION	GRAND STAIRCASE-ESCALANTE	KANE	BUREAU OF LAND MGMT

Serial Number: UTU--- - 078759

Act Date	Code	Action	Action Remarks	Pending Office
10/01/1999	387	CASE ESTABLISHED	GSMN ACQ OF COAL LEAS	
12/16/1999	865	TITLE ACCEPTED BY US	RELINQUISHMENT FILED	
12/27/1999	968	CASE ACTION COMPLETED	RELINQ. ACC BY SEC IN	
12/29/1999	095	FUNDED BY LWCF		
12/29/1999	500	GEOGRAPHIC NAME	GSENM;	
12/29/1999	542	SUPPLEMENTAL USE/PURPOSE	053;	
12/29/1999	859	PAYMENT MADE	$14,000,000;	

Serial Number: UTU--- - 078759

Line Nr	Remarks
0001	RE: COAL LEASES U-087805 ET AL.

DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
CASE RECORDATION
(MASS) Serial Register Page

RunDate/Time: 09/26/01 07:44 AM

01 10-21-1976;090STAT2755;43USC1715
Case Type 210013: ACQ-FLPMA
Commodity 001: NONE
Case Disposition: AUTHORIZED

Total Acres
18,325.160

Serial Number
UTU--- - 078758

Serial Number: UTU--- - 078758

Name & Address				Int Rel	% Interest
BLM	BOX 45155	SALT LAKE CITY UT 841450155		ACQUIRING AGENCY	100.000000000
PACIFICORP	201 S MAIN ST #2100	SALT LAKE CITY UT 841400021		LESSEE	0.000000000

Serial Number: UTU--- - 078758

Mer Twp Rng Sec	STyp	SNr	Suff	Subdivision	District/Resource Area	County	Mgmt Agency
26 0360S 0020E 013	ALIQ			S2NE,SE;	GRAND STAIRCASE-ESCALANTE	GARFIELD	BUREAU OF LAND MGMT
26 0360S 0020E 014	ALL			ENTIRE SECTION	GRAND STAIRCASE-ESCALANTE	GARFIELD	BUREAU OF LAND MGMT
26 0360S 0020E 023	ALL			ENTIRE SECTION	GRAND STAIRCASE-ESCALANTE	GARFIELD	BUREAU OF LAND MGMT
26 0360S 0020E 024	ALL			ENTIRE SECTION	GRAND STAIRCASE-ESCALANTE	GARFIELD	BUREAU OF LAND MGMT
26 0360S 0020E 025	ALL			ENTIRE SECTION	GRAND STAIRCASE-ESCALANTE	GARFIELD	BUREAU OF LAND MGMT
26 0360S 0020E 026	ALL			ENTIRE SECTION	GRAND STAIRCASE-ESCALANTE	GARFIELD	BUREAU OF LAND MGMT
26 0360S 0020E 035	ALL			ENTIRE SECTION	GRAND STAIRCASE-ESCALANTE	GARFIELD	BUREAU OF LAND MGMT
26 0370S 0020E 001	ALL			ENTIRE SECTION	GRAND STAIRCASE-ESCALANTE	GARFIELD	BUREAU OF LAND MGMT
26 0370S 0020E 011	ALL			ENTIRE SECTION	GRAND STAIRCASE-ESCALANTE	GARFIELD	BUREAU OF LAND MGMT
26 0370S 0020E 012	ALL			ENTIRE SECTION	GRAND STAIRCASE-ESCALANTE	GARFIELD	BUREAU OF LAND MGMT
26 0370S 0020E 013	ALL			ENTIRE SECTION	GRAND STAIRCASE-ESCALANTE	GARFIELD	BUREAU OF LAND MGMT
26 0370S 0020E 024	ALL			ENTIRE SECTION	GRAND STAIRCASE-ESCALANTE	GARFIELD	BUREAU OF LAND MGMT
26 0370S 0020E 025	ALL			ENTIRE SECTION	GRAND STAIRCASE-ESCALANTE	GARFIELD	BUREAU OF LAND MGMT
26 0360S 0030E 019	ALL			ENTIRE SECTION	GRAND STAIRCASE-ESCALANTE	GARFIELD	BUREAU OF LAND MGMT
26 0360S 0030E 030	ALL			ENTIRE SECTION	GRAND STAIRCASE-ESCALANTE	GARFIELD	BUREAU OF LAND MGMT
26 0370S 0030E 005	ALL			ENTIRE SECTION	GRAND STAIRCASE-ESCALANTE	GARFIELD	BUREAU OF LAND MGMT
26 0370S 0030E 006	ALL			ENTIRE SECTION	GRAND STAIRCASE-ESCALANTE	GARFIELD	BUREAU OF LAND MGMT
26 0370S 0030E 007	ALL			ENTIRE SECTION	GRAND STAIRCASE-ESCALANTE	GARFIELD	BUREAU OF LAND MGMT
26 0370S 0030E 031	ALL			ENTIRE SECTION	GRAND STAIRCASE-ESCALANTE	GARFIELD	BUREAU OF LAND MGMT
26 0380S 0030E 003	ALL			ENTIRE SECTION	GRAND STAIRCASE-ESCALANTE	KANE	BUREAU OF LAND MGMT
26 0380S 0030E 004	ALL			ENTIRE SECTION	GRAND STAIRCASE-ESCALANTE	KANE	BUREAU OF LAND MGMT
26 0380S 0030E 005	ALL			ENTIRE SECTION	GRAND STAIRCASE-ESCALANTE	KANE	BUREAU OF LAND MGMT
26 0380S 0030E 017	ALL			ENTIRE SECTION	GRAND STAIRCASE-ESCALANTE	KANE	BUREAU OF LAND MGMT

Serial Number: UTU--- - 078758

Act Date	Code	Action	Action Remarks	Pending Office
01/06/2000	387	CASE ESTABLISHED	GSMN ACQ OF COAL LSE	
01/07/2000	095	FUNDED BY LWCF		
01/07/2000	500	GEOGRAPHIC NAME	GSENM;	
01/07/2000	542	SUPPLEMENTAL USE/PURPOSE	053;	
01/07/2000	865	TITLE ACCEPTED BY US	RELINQUISHMENT FILED	
01/07/2000	968	CASE ACTION COMPLETED	RELINQ. ACC BY SEC IN	
01/10/2000	859	PAYMENT MADE	$5,500,000;	

Serial Number: UTU--- - 078758

Line Nr	Remarks
0001	RE: COAL LEASE U-1362

0030

Copy Baron, Rm
Mary Anne
File Interagency

MEMORANDUM OF UNDERSTANDING BETWEEN THE UTAH SCHOOL AND INSTITUTIONAL TRUST LANDS ADMINISTRATION, THE UNITED STATES DEPARTMENT OF AGRICULTURE, AND THE UNITED STATES DEPARTMENT OF THE INTERIOR

Recitals

1. The Utah Schools and Land Exchange Act of 1998, Pub. L. No. 105-335, 112 Stat. 3139 ("the Act"), ratified the May 8, 1998, "Agreement to Exchange Utah School Trust Lands Between the State of Utah and the United States of America" entered into between the State of Utah and the United States of America ("the Agreement").

2. The United States Department of the Interior ("DOI"), and the Utah School and Institutional Trust Lands Administration ("SITLA") each have responsibilities to implement the terms of the Agreement. The United States Department of Agriculture, Forest Service ("USDA-Forest Service"), which has jurisdiction, custody, and control over National Forest System Lands ("NFS lands"), is also subject to the terms of the Act and the Agreement with respect to NFS lands involved in the exchange of lands and interests in lands. Therefore, USDA-Forest Service is a Party to this MOU with respect to the NFS lands subject to the terms of the Act and the Agreement. The aforementioned entities will be collectively referred to hereinafter as "the Parties," or separately as a "Party."

3. The Parties recognize that it is in their mutual interest to agree on how certain actions necessary to implement the Act and the Agreement will be effected, and therefore enter into this Memorandum of Understanding ("MOU").

4. Among other provisions, this MOU implements Sections 8 and 10 of the Agreement which defines the Parties' respective responsibilities for environmental remediation, waste management and environmental compliance activities associated with the lands which each Party has transferred, or will transfer, to the other pursuant to the Act. Section 8 contemplates remediation of the subject lands following the date of transfer of title, and this MOU, consistent with Section 8, provides that each Party will continue to be legally responsible, to the extent such responsibility exists at the time of transfer of title, for environmental response actions, including actions specified herein, on the land that each Party respectively transfers. Except as consistent with the Agreement, nothing in this MOU is intended to relieve any party of its substantive or procedural environmental obligations under existing State or Federal law.

5. Section 10 of the Agreement calls for development of any mineral interests transferred to the State of Utah where the United States retains ownership interests in the land to be subject to all laws, rules, and regulations applicable to development of non-Federal mineral interests underlying Federally-owned surface, including laws, rules, and regulations applicable to such development within the National Forest System. The Regulations of the Secretary of Agriculture at Title 36, Code of Federal Regulations ("C.F.R."), section 251.50 will apply to the occupancy and use of the surface estate of National Forest System lands for the development of the conveyed coal estate . However, mining induced subsidence need not be permitted separately

where the State of Utah has authorized mining in accordance with 30 C.F.R. section 944.30, Article VI, B.5. To the extent provided by law, in surface occupancy permits and conditions of concurrence to mining permits, the USDA-Forest Service will abide by the standards and guidelines contained in the Land and Resource Management Plan for the Manti-La Sal National Forest which were in effect on May 8, 1998. Subject to reasonable terms and conditions for the protection of the surface estate consistent with the Forest Plan, any permit requirement may not prohibit reasonable economic development of the conveyed coal estates.

Memorandum of Understanding

I. Coal Mineral Interests

A. Pre-Leasing Issues

Before SITLA issues a lease on the Cottonwood, Westridge, Mill Fork, Dugout, Muddy, or North Horn Tracts conveyed to SITLA under paragraphs 3(F), 3(G), 3(K), 3(L), and 3(M) of the Agreement --

1. Within an agreed time frame, DOI's Bureau of Land Management ("BLM") will provide SITLA with the following for that tract:

a. The amount of the coal reserves for the tract;

b. A pre-lease estimate of fair market value ("FMV"), or comments on SITLA's consultant's assessment of FMV; and

c. Recommendations to SITLA on lease bond amounts.

2. For that tract, SITLA will --

a. Coordinate sale schedules with BLM;

b. Consider BLM's determination of, or comments on, coal reserves and FMV when it negotiates bonus bids with prospective lessees;

c. Establish the amount of the lease bond in consultation with BLM; and

d. Cooperate with the USDA- Forest Service to identify the applicable Forest Plan standards and guidelines necessary to protect National Forest Resources and to fulfill the requirements of Title 36 C.F.R. section 251.50.

B. Lease Instrument Contents

SITLA agrees that for each lease SITLA issues on lands subject to reversion to the United States under sections 3(F), 3(K), 3(L), and 3(M) of the Agreement (the Cottonwood, Mill Fork, Dugout, Muddy, and North Horn Tracts), SITLA will include the following in the lease terms:

1. The reversionary provisions of the Agreement and the Act that apply to the individual lease.

2. An express agreement by the lessee as follows:

> The lessee agrees that after reversion of the lessor's interest to the United States, the Secretary of the Interior may establish the reasonable value of post-reversion production for royalty purposes in the same manner and by the same methods as the United States establishes value under Federally-issued leases.

3. An express agreement by the lessee as follows:

> The lessee agrees that after reversion, the lessee will be subject to the requirements of the Mineral Leasing Act. 30 U.S.C. §§ 181 *et seq.*, and royalty, operating, and administrative procedure rules and regulations of the Department of the Interior, the Minerals Management Service ("MMS"), and the Bureau of Land Management ("BLM") and any other Federal laws and regulations generally applicable to coal leases issued under the Mineral Leasing Act to the same extent as if the lease were a Federally-issued lease. However, to the extent that SITLA approves a significant operational decision and the lessee makes a substantial economic commitment based upon SITLA's approval, the lessee may continue to rely on that approval after reversion. Provided, however, that nothing herein will affect the liability of the lessee under CERCLA, RCRA, the Clean Water Act, 33 U.S.C. § 1251, *et seq.*, or other applicable environmental law.

4. Express agreements by the lessee relating to "Hazardous Substances," and "Indemnification" that are appended to this MOU as Appendix 1. Prior to the issuance of any lease, the Parties further agree to jointly develop provisions to address "Waste Certification," "Discharges of Oil," "Oil Discharge Indemnity," and "Discharged Oil Certification" for inclusion in leases. If necessary, the Parties may modify language provided in Appendix 1 to bring the provisions of Appendix 1 into conformance with the subsequently developed provisions.

5. An express agreement by the lessee as follows:

> The lessee agrees that it will furnish bonds or other financial guarantees meeting both State and Federal mineral lease bond or

financial guarantee requirements and that upon any forfeiture after reversion, those bonds or financial guarantees will be payable to the Secretary of the Interior.

6. An express agreement by the lessee as follows:

The lessee agrees that it will report production and royalties monthly in accordance with applicable State requirements and, after reversion, in accordance with applicable Federal regulations.

7. An express agreement by the lessee as follows:

The lessee agrees that the BLM may conduct underground inspections of all mines on the leased premises, regardless of whether the BLM is acting in cooperation with the Utah School and Institutional Trust Lands Administration as lessor or under the authority of Federal laws and regulations after any reversion of the lessor's interest to the United States.

C. **Post-Leasing Issues**

1. After SITLA issues any lease on the Cottonwood, Mill Fork, Dugout, Muddy, or North Horn Tracts, in cooperation with SITLA BLM will:

a. Inspect underground operations on a quarterly or other agreed upon basis to, among other things, verify production amounts and to determine compliance with the hazardous waste certification stipulation. Inspections will be coordinated, scheduled, and conducted jointly, if possible, with SITLA. BLM will notify SITLA of any underground and related surface operational problems observed or suggest remedial actions;

b. Provide SITLA with timely technical advice for SITLA's mining plan approvals and modifications and lease modifications. Such advice will address issues relating to maximum economic recovery ("MER") and avoiding coal bypass; and

c. Provide SITLA with timely technical advice regarding potential coal bypass and hazardous waste certification concerns on any lease relinquishment proposals.

2. After SITLA issues any lease on the Cottonwood, Mill Fork, Muddy, or North Horn Tracts, in cooperation with SITLA the USDA-Forest Service will:

a. Apprise SITLA of any concerns with respect to compliance with the hazardous waste certification stipulation or other surface operational problems concerning operations on NFS lands:

b. Provide SITLA timely information and/or comments on the surface effects of underground mining with respect to SITLA's mining plan approvals and modifications, lease modifications, and lease relinquishments; and

c. Timely process any surface use permits necessary to support the development of the coal interest.

3. After SITLA issues any lease on the Cottonwood, Mill Fork, Dugout, Muddy, or North Horn Tracts, SITLA will:

a. Provide BLM and the USDA- Forest Service, where NFS lands are involved, timely copies of all applications for mining plan approvals and modifications and lease modifications and relinquishments, and will consider BLM and USDA-Forest Service comments in determining whether to approve such applications and in developing any special approval conditions;

b. Report to BLM total royalty and rental income derived from all leases SITLA issues on the Cottonwood Tract conveyed under paragraph 3(F) of the Agreement by March 1 of each year for the preceding calendar year. When the total royalty and rental income is within one million dollars of the amount that triggers reversion to the United States, SITLA will report to BLM each month the total royalty and rental income derived from these leases;

c. Report to BLM by March 1 of each year for the preceding calendar year the total production from all leases SITLA issues on each of the following tracts. When the total production from all leases on each of the following tracts reaches the corresponding tonnage stated below, SITLA will report to BLM each month the total production from the tract:

Mill Fork Tract (Agreement § 3(K))	21 million tons
Dugout Canyon and Muddy Tracts (Agreement § 3(L))	33 million tons
North Horn Coal Tract (Agreement § 3(M))	99 million tons

For purposes of this paragraph (c), and for determining when reversion occurs for the Mill Fork, Dugout Canyon and Muddy, and North Horn Tracts under the cited Agreement provisions, coal is considered to be produced when it is subject to royalty under the SITLA lease; and

d. Be reasonable and prudent in making operational and other lease management decisions that would likely have consequences extending past the reversion date. SITLA agrees that it will provide BLM and the USDA-Forest Service with an opportunity to provide advice regarding those decisions. SITLA further agrees that for all such decisions made within one year of the expected reversion date, BLM must concur with such decisions, such consent not to be unreasonably withheld.

D. Reversion Issues

1. SITLA agrees that all royalties received on production beyond the royalty and rental income or tonnage amounts that trigger the reversion to the United States as provided in paragraphs 3(F), 3(K), 3(L), and 3(M) of the Agreement in the month in which the threshold royalty and rental income or tonnage amount is reached will be paid to MMS by the last day of the second month following the month in which the royalty or rental income or tonnage threshold amount is reached.

2. Any coal produced from a lease subject to reversion that was stockpiled before reversion for which no royalty was paid to SITLA will be subject to payment of royalty to the United States in accordance with MMS regulations.

3. Upon the occurrence of conditions subsequent, specific to each tract identified in section 3(F), 3(K), 3(L), and 3(M) of the Agreement (the Cottonwood, Mill Fork, Dugout, Muddy, and North Horn Tracts), each such tract will revert to the United States. Notwithstanding such reversion, SITLA will remain responsible for: identifying the location of any reportable release of hazardous substances or the discharge of oil (as those terms are defined in Part IV of this MOU) prior to the reversion; characterizing the environmental condition of each such tract at the time of reversion; and taking any response actions necessary for compliance with all applicable Federal or State laws, arising from environmental conditions existing on each such tract at the time of reversion, consistent with each tract's future anticipated use. SITLA will transmit to the United States not more than two years prior to the expected date of reversion a schedule for the completion of such actions prior to the date of reversion. If there is disagreement as to the urgency, necessity, or degree of the response action required, the Parties will use the dispute resolution procedure identified under this MOU.

4. Under section 3(F) of the Agreement, the coal mineral interest in the Cottonwood Tract reverts to the United States after SITLA receives $13,006,105 in royalty and rental income. The Agreement also notes that such amount may be subject to adjustment for interest. The Parties agree to determine the reversion as follows:

a. Under the Agreement, the $13,006,105 is an amount that SITLA is entitled to above what the State would have received under the provisions of 30 U.S.C. 191 had all or part of the Cottonwood Tract been leased by the United States. Therefore, the reversion will occur after SITLA receives $26,012,210 in rental and royalty income from disposition of all or part of the coal mineral interest in the Cottonwood Tract, subject to adjustment under paragraph I.D.4(b). One-half of what SITLA receives each month will reduce the $13,006,105 principal balance due under the Agreement and be used to pay accrued interest under paragraph I.D.4.(b).

b.(i) To compensate SITLA for the time value of the money until it receives the additional $13,006,105 under the Agreement, interest will be calculated at the end of each month on the average daily remaining principal balance for that month (which starts at $13,006,105). The interest rate will be the rate for a five-year Treasury note on the last business day of that month. Interest will be calculated as simple interest and will begin accruing January 8, 1999.

(ii) When SITLA receives rental or royalty income, on the day of receipt such amounts will be applied first to accrued interest, and any remaining amount will reduce the principal balance.

For example, assume that interest on $13,006,105 is $50,000 per month ($30,000 for January 1999). For the first six months, $280,000 in interest would accrue (no interest accrues on the outstanding interest balance) and the principal balance would be unchanged. On the first day of Month Seven, a lessee pays $200,000 in rental. Under paragraph I.D.4.(a), $100,000 would be applied to reduce the interest balance from $280,000 to $180,000 and the principal balance would not be reduced. But if in Month Seven that lessee paid $800,000 in rentals instead of $200,000, then $400,000 would be applied to the outstanding principal and interest. First, $280,000 would be used to pay accrued interest, and then $120,000 would be used to reduce the principal balance. At the end of Month Seven, interest would be calculated on a principal balance of $12,886,105 (assuming that is the average daily outstanding principal balance for the month). Rental interest in Month Eight would be applied first to that interest, and then the remainder would further reduce the $12,886,105 principal balance.

Reversion will occur after SITLA receives rental and royalty income from some or all of the coal mineral interest in the Cottonwood Tract totaling $26,012,210 plus an amount equal to the total of the simple interest calculated on the principal balance under this paragraph.

5. To insure uninterrupted operations on coal leases that revert to the United States pursuant to the Agreement, SITLA's approval of a mine plan after consultation with BLM and USDA-Forest Service (with respect to National Forest System lands) pursuant to the terms of this Memorandum of Understanding, and the Utah Division of Oil, Gas, and Mining's (DOGM) final approval of a mine permit for such state leases under the Surface Mining Control and Reclamation Act of 1977, will be deemed to satisfy any requirements for federal mining plan or resource recovery and protection plan approval under 30 C.F.R. Part 746 and 43 C.F.R. Group 3400 applicable at the time of reversion, together with any requirements for concurrence in such plans or permits by USDA- Forest Service applicable at the time of reversion. To the extent that approvals by the State Historic Preservation Officer (SHPO), consultations with the U.S. Fish and Wildlife Service pursuant to Section 7 of the Endangered Species Act, or other necessary consultations or approvals were completed at the time of the original mine permit issuance, then such approvals shall continue in effect and be deemed to satisfy any requirements or for such consultations or approvals at the time of reversion. No later than one year prior to the anticipated date of the reversion of each tract, the parties will consult with each other, the lease operator, and the DOGM to determine whether additional approvals or consultations will be required, and each Party agrees to take such steps and execute such documents as may be reasonably necessary to ensure uninterrupted operations upon reversion.

6. If SITLA approves a significant operational decision and the lessee makes a substantial economic commitment based upon SITLA's approval, BLM agrees after reversion to abide by SITLA's approval.

II. Oil and Gas, Coal, and Other Mineral Royalty Issues

A. The State is entitled to all royalty revenues derived from existing leases on lands the State is conveying to the United States under the Agreement on production occurring before the date the lands are conveyed to the United States. The United States is entitled to all royalty revenues derived from existing leases on lands the United States is conveying to the State under the Agreement on production occurring before the date the lands are conveyed to the State.

B. If conveyance to the United States of lands subject to existing State-issued leases does not occur on the first day of the period for which royalties accrue (for example, a production month for oil and gas leases or the month of shipment, sale, processing, or use for coal leases), the State is entitled to that proportion of the royalty revenues derived from the lease for that period that equals the number of days in the period before the date of conveyance divided by the number of days in the period. If conveyance to the State of lands subject to existing Federal leases does not occur at the beginning of a production month, the United States is entitled to that portion of the royalty revenues derived from the lease for that month that equals the number of days in the month before the date of conveyance divided by the number of days in the month.

For example, assume conveyance occurs on January 8, 1999. For an oil and gas lease that requires monthly royalty payment, the transferor would retain 8/31 of the royalties due for January production. The transferee would be entitled to 22/31 of the royalties due for January production. For a mineral lease that requires quarterly royalty payments, the transferor would retain 8/90 of the royalties derived from production in the first quarter of 1999, and the transferee would be entitled to 82/90 of those revenues.

C. If either Party receives lease revenues to which the other Party is entitled under the Agreement, the Party first receiving the money agrees to pay the amount to which the other Party is entitled by the end of the second month following the month in which the revenues were received.

D. If annual lease rental payments for mineral leases are due before the date of conveyance, the Party to whom the rental payment is owed on the due date is entitled to retain the entire rental payment, regardless of whether the lease goes into production during the year for which rental was paid.

E.1. If --

a. the lands within a single lease are segregated as a result of a conveyance under the Agreement; and

b. the lease was not committed to any Federally-approved unit or communitization agreement before conveyance,

then the Parties agree that so long as there is production in paying quantities from any well on either of the segregated parcels, such production will hold each of the segregated leases in full force and effect.

2. a. If the well spacing unit from which production occurs lies entirely within the boundaries of one of the segregated parcels, royalties on that production are payable only to the Party who is the lessor of that parcel.

b. If a well spacing unit has been established or is established in the future, and parts of the spacing unit are within both of the segregated parcels, the Parties will allocate royalties based on the proportionate acreage of the spacing unit within each parcel.

F. SITLA agrees that under section 3(P)(ii) of the Agreement, it will pay to MMS 50 percent of the bonus bid it receives when it issues each lease under section 3(P)(i) of the Agreement, reduced by 50 percent of administrative costs as prescribed in section 3(P)(ii), no later than the last day of the second month following the month in which the State receives the bonus payment. The Parties further agree that for any lands or interests in land that the State receives from the United States under the Agreement that are subject to an existing mineral lease, SITLA may amend or replace a Federally-issued lease instrument, with the lessee's consent, and not be subject to section 3(P)(i) as long as SITLA does not extend the lease term or add previously unleased acreage.

III. Mining Claim Administration

If any of the lands conveyed to the State under the Agreement are encumbered by mining claims, mill sites, or tunnel sites located under the Mining Law of 1872, 30 U.S.C. § 22 *et seq.* --

A. SITLA will:

1. Recognize the mining claimants' and site holders' interests in all valid mining claims and site locations as property interests and allow them to develop those minerals or use the sites so long as they comply with applicable laws and regulations including without limitation applicable state filing and claim maintenance requirements; and

2. Adjudicate any mining claim or site validity issues in the appropriate state or Federal court according to the Mining Law of 1872, as amended, and case law interpreting that law.

B. BLM will provide notice to each mining claimant and site holder that its mining claims or site locations --

1. Will be administered by SITLA and that compliance with the state filing and claim maintenance requirements contained in Utah Code Ann. Section 53C-2-104 will be required to avoid abandonment of such claim under state law;

2. Will no longer be administered by the United States;

3. Will no longer be subject to Federal filing or fee requirements or BLM surface management requirements; and

4. That the Secretary of the Interior no longer has jurisdiction to adjudicate the validity of any mining claim or site.

IV. Environmental Compliance

A. Definitions.

1. With respect to this Part IV of this MOU, unless otherwise defined herein, all terms have the meaning provided under the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. § 9601, *et seq.*, and other applicable Federal environmental laws.

2. The term "land" means lands, resources, and interests therein.

3. The term "hazardous substance" means any substance designated under 42 U.S.C. § 9601(14); any regulated substance contained in, or released from, any underground storage tank, as defined by the Resource Conservation and Recovery Act at 42 U.S.C. § 6991, *et seq;* and any substance defined and regulated as "hazardous" by applicable State law.

4. The terms "oil" and "discharge" are defined by the Clean Water Act at 33 U.S.C. §1321(a)(1) and 33 U.S.C. §1321(a)(2), respectively.

B. Environmental Compliance Responsibilities

The Parties agree to the following:

1. Apportionment of Costs and Funding of Obligations

Each Party will be responsible for the costs associated with response actions and other actions specified in this Part IV, on lands it transfers, except as provided in section IV(B)(2) of this MOU. Commitments of any funds made pursuant to Part IV of this MOU will be subject to the availability of appropriated funds. No provision of this Agreement requires the United States to obligate or pay funds in contravention of the Anti-Deficiency Act, 31 U.S.C. § 1341, in any fiscal year for actions

subject to the Agreement and this MOU. No provision of this Agreement obligates the State of Utah or SITLA to obligate or pay funds not appropriated by the Utah legislature.

2. Assessment of Presumptive Baseline Contamination Existing at the Time of Transfer

The Parties agree that they will conduct an investigation to establish a presumptive baseline of sites on which a release of hazardous substances or discharge of oil has occurred (hereinafter, "release sites"). The investigation will include an examination by the United States of the lands to be transferred by the Parties and a complete search by SITLA and the State of files located in the Utah Department of Environmental Quality pertaining to actions on the lands transferred as part of the investigation. The Parties will complete such investigation prior to the date of transfer. The release sites identified will constitute the presumptive baseline release sites existing on the lands to be transferred at the time of transfer. The Parties are aware of the contractors, processes and methodologies that will be used in the investigation, and agree that the contractors, processes and methodologies are sufficient to establish the presumptive baseline release sites. The State or SITLA will contribute $115,000 as its share of the investigation within 60 days from the date of transfer, for the United States' Bureau of Land Management's investigation pursuant to Bureau of Land Management Contract No. 1422-N651-C4-3049, Task Order 98-5758, of the lands that the State or SITLA will transfer to the United States. Simultaneous with the payment of such amount by the State or SITLA, the United States will assign to the State or SITLA all rights of action against the contractor, C.C. Johnson and Mahotra, arising out of the aforementioned contract.

3. Grant of Mutual Right of Access

The Partics will grant reciprocal rights of access to the transferred lands for the limited purpose of taking any and all necessary actions related to the release, or potential release, of hazardous substances or discharge of oil located on the subject lands and to conduct any and all actions required under the terms of this MOU. Future use authorizations issued to third Parties will be subject to rights of access under this paragraph. Each grant of access will be of such terms as are mutually acceptable to the Parties.

4. Characterization of Contaminated Lands

a. The Parties will meet not later than 60 days after the date of transfer to address the need for any further investigation, or any further environmental characterization, of sites identified under Section IV(B)(2) of this MOU. At a minimum, the Parties agree to gather such additional information as is necessary to develop recommendations regarding any needed response actions to ensure compliance with all applicable Federal and State laws, and to determine the urgency of such action.

b. Characterization of the lands identified under Section IV(B)(2) will be completed under the terms established under section IV(B)(4)(a) within 180 days after the date of transfer. The Parties will make this information available to each other as it becomes available.

c. In the event that additional time is needed to complete any characterization required, including any additional characterizations required as a result of information gathered by the Parties, the Parties will consult with each other and agree as to the amount of time necessary to complete such characterization.

5. Response Actions on Contaminated Lands

The Parties will meet not later than 240 days after the date of transfer to develop plans to address the necessity or urgency of response actions on the characterized release sites. Each Party, to the extent responsible under any State or Federal law applicable at the time of transfer, will address environmental conditions on the lands, which it has or will transfer, so that the lands are in compliance with all applicable Federal or State law governing the release of hazardous substances or the discharges of oil. The Parties will conduct response actions on any contaminated lands to achieve a permanent remedy of conditions on the lands which pose a present or future threat to human health or the environment, and to a condition consistent with the lands' reasonably anticipated future land use, as identified by the Party to whom the land was or will be transferred. If there is disagreement as to the urgency, necessity, or degree of response action required, the Parties will use the dispute resolution procedure identified under this MOU. Nothing herein prevents any Party from seeking contribution or indemnification for the costs of response action from any persons or entities who contaminated the lands or otherwise ensuring that responsible parties perform or contribute their share of the costs of response actions.

6. Further Response Actions

As provided by this Section IV(B)(6), the Party that will transfer or has transferred the subject land (hereinafter, "transferring Party") will conduct and fund any reasonable additional response action determined to be necessary by the Party which has or will receive the subject land (hereinafter, "non-transferring Party") after response actions under Section IV(B)(5) have been completed if:

a. The remedy fails (e.g., the remedy fails to meet previously identified response action goals or response objectives) and such failure occurs not as a result of the acts or omissions of the non-transferring Party;

b. Additional hazardous substance releases or discharges of oil are identified, which are demonstrated by the non-transferring Party to have existed on the subject land prior to transfer and have not been previously identified, that create conditions inconsistent with the established reasonably anticipated land use; or

c. A statute, a regulation, a final and binding court order, or a final and binding administrative order necessitates additional response actions to address the presence of hazardous substances or discharges of oil attributable to the transferring Party on the property, provided that the order is not occasioned by the non-transferring Party's physical activities on the property.

7. **Dispute Resolution**

If a dispute arises under Part IV of this MOU that is not resolved informally between the United States and the State or SITLA, then either Party may pursue the following dispute resolution procedure:

a. The Party which seeks resolution will provide a written statement of its dispute, along with any rationale or supporting documents, to the other Party. The Parties will engage in discussions in an attempt to arrive at a consensus and resolve the dispute.

b. If no resolution is reached within thirty (30) calendar days of receipt of the statement of dispute, then the dispute may be elevated to the Parties' respective headquarters-level officials, or their designees. The headquarters-level officials for the United States and Utah will engage in discussions in an attempt to arrive at a consensus. If consensus is not achieved, the Parties will refer the matter in accordance with section IV(B)(7)(c) within thirty (30) calendar days.

c. Any matter referred under section IV(B)(7)(b) will be elevated to the principal environmental policy makers for the State or SITLA and the Department of the Interior, or the Department of Agriculture in the case of a matter concerning NFS lands, who will resolve the matter, and transmit their determination in written form to the Parties involved. In the case of Utah, the principal environmental policy maker is the Governor of Utah or his or her designee. In the case of the United States, the principal environmental policy maker is the Assistant Secretary, Land and Minerals Management or his or her designee, except that with respect to matters involving NFS lands, the principal environmental policy maker is the Under Secretary for Natural Resources and Environment or his or her designee.

d. These time limits may be extended on the mutual agreement of the Parties to the dispute.

V. **Other General Provisions**

A. The Parties will each provide notification of the conveyance and the terms of the Agreement and this Memorandum of Understanding to any current lessees, permittees, and mining claimants of record who hold interests in any lands subject to conveyance under the Agreement.

B. For any contract for mineral materials under the Materials Act of 1947, 30 U.S.C. §§ 601-604, applicable to lands conveyed to the State under the Agreement, payments under the contract due to the United States for materials severed, extracted, or removed before the date of conveyance will be paid to the United States.

C. For all non-mineral-related revenues (including for grazing permits and leases, rights-of-way, recreation permits, filming permits, etc.), whichever Party is entitled to a payment due before the date of conveyance will retain the full amount of the payment.

D. SITLA, BLM, and the USDA-Forest Service with respect to NFS lands, will share information regarding properties transferred under the Agreement, except that proprietary coal data and proprietary coal company data will not be shared with the USDA- Forest Service. SITLA, BLM and the USDA-Forest Service will maintain the confidentiality of all proprietary and confidential information to the extent authorized under applicable law.

E. SITLA, BLM, and the USDA-Forest Service with respect to NFS lands, will work to establish Intergovernmental Personnel Act assignments from their respective staffs to further the implementation of this Memorandum of Understanding.

F. SITLA and BLM, and the USDA-Forest Service with respect to NFS lands, each will provide technical assistance to the other to facilitate implementation of the Agreement.

G. With respect to any administrative appeals within DOI, USDA-Forest Service or the State pending on the date of conveyance involving lands conveyed to SITLA or to the United States under the Agreement that encompass issues that may have prospective implications, the Parties agree to work cooperatively to analyze and resolve the effect of the conveyance on those matters.

H. Each Party conveying land under the Agreement will, upon request of the Party receiving the land, seek to enforce existing surety or financial guarantees for unfulfilled lease obligations existing on the date of conveyance that the lessee does not correct.

I. SITLA agrees that if MMS does not receive any of the amounts due under the Agreement by the date those amounts are due under this Memorandum of Understanding, SITLA will pay interest on any unpaid amount from the date due until the date paid at the same five-year Treasury note simple interest rate prescribed in section I.D.4.(b) of this Memorandum of Understanding.

J. Nothing in this Memorandum of Understanding is intended to limit the rights or obligations of the Parties under the Act or Agreement.

K. This Memorandum of Understanding is subject to modification by later agreement in writing.

L. For purposes of this Memorandum of Understanding, references to the State of Utah may mean SITLA, and references to SITLA may mean the State of Utah, as the context requires.

M. This Memorandum of Understanding may be executed in counterparts, each to be considered an original for all purposes, and collectively to be considered a single document.

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VI. **Exclusion**

This Memorandum of Understanding does not apply to lands conveyed to the United States under paragraphs 2(A) and 2(B) of the Agreement, which the United States will hold in trust for the Navajo Nation and Goshute Tribe, respectively, and which will be the subject of a separate Memorandum of Understanding among the Parties and the Navajo Nation and Goshute Tribe.

IN WITNESS WHEREOF, the Parties have executed this Agreement.

FOR THE UNITED STATES DEPARTMENT OF THE INTERIOR

By: _____

Title: _____

Date: _____

FOR THE UTAH SCHOOL AND INSTITUTIONAL TRUST LANDS ADMINISTRATION

By: David T Terry

Title: DIRECTOR

Date: JANUARY 5, 1999

APPROVED AS TO FORM:
JAN GRAHAM
ATTORNEY GENERAL

By _____

FOR THE UNITED STATES DEPARTMENT OF AGRICULTURE

By: _____

Title: _____

Date: _____

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IN WITNESS WHEREOF, the Parties have executed this Agreement.

FOR THE UNITED STATES DEPARTMENT OF THE INTERIOR

By: Sylvia V Baca

Title: Acting Assistant Secretary, Land and Minerals Management

Date: JAN - 5 1999

FOR THE UTAH SCHOOL AND INSTITUTIONAL TRUST LANDS ADMINISTRATION

By: _____

Title: _____

Date: _____

FOR THE UNITED STATES DEPARTMENT OF AGRICULTURE

By: _____

Title: _____

Date: _____

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This Memorandum of Understanding does not apply to lands conveyed to the United States under paragraphs 2(A) and 2(B) of the Agreement, which the United States will hold in trust for the Navajo Nation and Goshute Tribe, respectively, and which will be the subject of a separate Memorandum of Understanding among the Parties and the Navajo Nation and Goshute Tribe.

IN WITNESS WHEREOF, the Parties have executed this Agreement.

FOR THE UNITED STATES DEPARTMENT OF THE INTERIOR

By: _____

Title: _____

Date: _____

FOR THE UTAH SCHOOL AND INSTITUTIONAL TRUST LANDS ADMINISTRATION

By: _____

Title: _____

Date: _____

FOR THE UNITED STATES DEPARTMENT OF AGRICULTURE

By: Anne Keys Kennedy

Anne Keys Kennedy

Title: Deputy Under Secretary, Natural Resources and Environment

Date: JAN - 5 1999

APPENDIX 1

Provisions relating to "Hazardous Substances," and "Indemnification" in each lease SITLA issues on lands subject to reversion to the United States under sections 3(F), 3(K), 3(L), and 3(M) of the Agreement (the Cottonwood, Mill Fork, Dugout, Muddy, and North Horn tracts) will include:

> Hazardous Substances. Lessee [or other occupant pursuant to any agreement authorizing mining] shall not keep on or about the premises any hazardous substances, as defined under 42 U.S.C. § 9601(14) or any other Federal environmental law, any regulated substance contained in, or released from, any underground storage tank, as defined by the Resource Conservation and Recovery Act at 42 U.S.C. § 6991, *et seq*, or substances defined and regulated as "hazardous " by applicable State law, (hereinafter, for the purpose of this paragraph, collectively referred to as, "Hazardous Substances") unless such substances are reasonably necessary in Lessee's mining operations, and the use of such substances or tanks is noted and approved in the Lessee's mining plan, and unless Lessee fully complies with all Federal, State and local laws, regulations, statutes, and ordinances, now in existence or as subsequently enacted or amended. Lessee shall immediately notify Lessor, the Bureau of Land Management, and any Federal, State and local agency with jurisdiction over the subject land, or contamination thereon, of (I) all reportable spills or releases of any Hazardous Substance affecting the Leased Premises, (ii) all failures to comply with any applicable Federal, state or local law, regulation or ordinance. as now enacted or as subsequently enacted or amended, (iii) all inspections of the Leased Premises by, or any correspondence, order, citations, or notifications form any regulatory entity concerning Hazardous Substances affecting the Leased Premises, (iv) all regulatory orders or fines or all response or interim cleanup actions taken by or proposed to be taken by any government entity or private Party concerning the Leased Premises.
>
> Hazardous Substances Indemnity. Lessee [or other occupant pursuant to any agreement authorizing mining] shall indemnify, defend, and hold harmless Lessor and the United States (as successor Lessor or owner pursuant to reversion or as owner of surface estate) its agencies, employees, officers, and agents with respect to any and all damages, costs, fees (including attorneys' fees and costs), penalties (civil and criminal), and cleanup costs assessed against or imposed as a result of Lessee's use, disposal, transportation, generation and/or sale or location upon or affecting the Leased premises of hazardous substances, as defined under 42 U.S.C. § 9601(14) or any other Federal environmental law, any regulated substance contained in, or released from, any underground storage tank, as defined by the Resource Conservation and Recovery Act at 42 U.S.C. § 6991, *et seq.*, or substances defined and regulated as "hazardous" by applicable State law, or that of Lessee's employees, agents, assigns, sublessees, contractors, subcontractors,

licensees or invitees, and for any breach of this lease's provisions concerning the aforementioned substances or tanks.

FIRST AMENDMENT TO MEMORANDUM OF UNDERSTANDING BETWEEN THE UTAH SCHOOL AND INSTITUTIONAL TRUST LANDS ADMINISTRATION, THE UNITED STATES DEPARTMENT OF AGRICULTURE, AND THE UNITED STATES DEPARTMENT OF THE INTERIOR

Recitals

A. The Utah Schools and Land Exchange Act of 1998, Pub. L. 105-335, 112 Stat. 3139 (the "Act"), ratified the May 8, 1998 "Agreement to Exchange Utah School Trust Lands Between the State of Utah and the United States of America" entered into between the State of Utah and the United States of America (the "Agreement").

B. On or about January 5, 1999, the United States Department of the Interior ("DOI"), the United States Department of Agriculture, Forest Service ("USDA-Forest Service"), and the Utah School and Institutional Trust Lands Administration ("SITLA") (collectively the "Parties") entered into a Memorandum of Understanding concerning the implementation of the Act and the Agreement (the MOU").

C. Pursuant to Section I.B. of the MOU, SITLA agreed that for each coal lease that SITLA issues on lands subject to reversion to the United States under sections 3(F), 3(K), 3(L) and 3(M) of the Agreement (the Cottonwood, Mill Fork, Dugout, Muddy and North Horn Tracts), SITLA would include certain specific lease provisions intended to protect the reversionary interests of the United States in those tracts.

D. The Parties desire to amend and restate Section I.B. of the MOU to provide more workable lease provisions.

E. The Parties further desire to amend the MOU to address unanticipated issues concerning venting of coalbed methane for safety reasons, issuance of potentially-conflicting leases and permits, confidentiality of operator data, and Mineral Leasing Act acreage limitations.

Amendment to Memorandum of Understanding

1. **Amended and Restated Section I.B.** Section I.B. of the MOU is hereby amended and restated in its entirety as follows:

B. Lease Instrument Contents

SITLA agrees that for each coal lease SITLA issues on lands subject to reversion to the United States under sections 3(F), 3(K), 3(L) and 3(M) of the Agreement (the Cottonwood, Mill Fork, Dugout, Muddy and North Horn Tracts), SITLA will include the following provisions in the lease terms:

1. Reversion of Leased Premises to United States. Pursuant to the May 8, 1998

"Agreement to Exchange Utah School Trust Lands Between the State of Utah and the United States of America", as ratified by Pub. L. No. 105-335, 112 Stat. 3139, ownership of the Leased Premises shall revert to the United States when _____ [INSERT TRACT-SPECIFIC REVERSION PROVISIONS HERE] _____. Upon reversion, the United States shall succeed the State of Utah as Lessor.

2. Royalty Valuation After Reversion. After reversion of the Leased Premises to the United States, the Secretary of the Interior may establish the reasonable value of post-reversion production for royalty purposes in the same manner and by the same methods as the United States establishes value under coal leases issued by the United States.

3. Regulation Upon Reversion. After reversion of the Leased Premises to the United States pursuant to paragraph ____, Reversion of Leased Premises to United States, Lessee will be subject to the requirements of the Mineral Leasing Act, 30 U.S.C. §§ 181 *et seq.* (the "MLA"), and to the royalty, operating, and administrative procedure rules and regulations of the Department of Interior, the Minerals Management Service, and the Bureau of Land Management, and to any other federal laws and regulations generally applicable to coal leases issued under the MLA to the same extent as if the Lease were a federally-issued lease. Notwithstanding the foregoing, to the extent that the State, as Lessor, approves a significant operational decision prior to reversion, and Lessee makes a substantial economic commitment based upon that approval, Lessee may continue to rely upon that approval after reversion; provided, however, that no such approval shall act to limit the liability of Lessee, if any, under CERCLA, RCRA, the Clean Water Act, 33 U.S.C. § 1251 *et seq* or other applicable environmental law. Upon reversion, nothing in this paragraph shall be deemed to require or suggest that the Leased Premises be included in the calculation of acreage held by Lessee for the purposes of the acreage limitation provisions of the MLA and associated regulations.

4. Hazardous Substances. Lessee [or other occupant pursuant to any agreement authorizing mining] shall not keep on or about the premises any hazardous substances, as defined under 42 U.S.C. § 9601(14) or any other Federal environmental law; any regulated substance contained in or released from any underground storage tank, as defined by the Resource Conservation and Recovery Act, 42 U.S.C. § 6991, *et seq;* or any substances defined and regulated as "hazardous" by applicable State law, (hereinafter, for the purposes of this Lease, collectively referred to as "Hazardous Substances") unless such substances are reasonably necessary in Lessee's mining operations, and the use of such substances or tanks is noted and approved in the Lessee's mining plan, and unless Lessee fully complies with all Federal, State and local laws, regulations, statutes, and ordinances, now in existence or as subsequently enacted or amended, governing Hazardous Substances. Lessee shall immediately notify Lessor, the Bureau of

Land Management, the surface management agency, and any other Federal, State and local agency with jurisdiction over the Leased Premises, or contamination thereon, of (i) all reportable spills or releases of any Hazardous Substance affecting the Leased Premises; (ii) all failures to comply with any applicable Federal, state or local law, regulation or ordinance governing Hazardous Substances, as now enacted or as subsequently enacted or amended; (iii) all inspections of the Leased Premises by, or any correspondence, order, citations, or notifications from any regulatory entity concerning Hazardous Substances affecting the Leased Premises; and (iv) all regulatory orders or fines or all response or interim cleanup actions taken by or proposed to be taken by any government entity or private Party concerning the Leased Premises.

5. Hazardous Substances Indemnity. Lessee [or other occupant pursuant to any agreement authorizing mining] shall indemnify, defend, and hold harmless Lessor and the United States (as successor Lessor or owner pursuant to reversion or as owner of surface estate) its agencies, employees, officers, and agents with respect to any and all damages, costs, liabilities, fees (including attorneys' fees and costs), penalties (civil and criminal), and cleanup costs arising out of or in any way related to Lessee's use, disposal, transportation, generation, sale or location upon or affecting the Leased Premises of Hazardous Substances, as defined in this Lease. This indemnity shall extend to the actions of Lessee's employees, agents assigns, sublessees, contractors, subcontractors, licensees and invitees. Lessee shall further indemnify, defend and hold harmless Lessor and the United States from any and all damages, costs, liabilities, fees (including attorneys' fees and costs), penalties (civil and criminal), and cleanup costs arising out of or in any way related to any breach of the provisions of this Lease concerning Hazardous Substances. This indemnity is in addition to, and in no way limits, the general indemnity contained in paragraph 16.1 of this Lease.

6. Waste Certification. The Lessee shall provide upon abandonment, transfer of operation, assignment of rights, sealing-off of a mined area, and prior to lease relinquishment, certification to the Lessor and the Bureau of Land Management that, based upon a complete search of all the operator's records for the Lease, and upon its knowledge of past operations, there have been no reportable quantities of hazardous substances as defined in 40 Code of Federal Regulations §302.4, or used oil as defined in Utah Administrative Code R315-15, discharged (as defined at 33 U.S.C. §1321(a)(2)), deposited or released within the Leased Premises, either on the surface or underground, and that all remedial actions necessary have been taken to protect human health and the environment with respect to such substances. Lessee shall additionally provide to Lessor and the Bureau of Land Management a complete list of all hazardous substances, hazardous materials, and their respective Chemical Abstracts Service Registry Numbers, and oil and petroleum products used or stored on, or delivered to, the Leased Premises. Such disclosure will be in addition to any other disclosure required by law or agreement.

7. Lease Bond Required. At the time this Lease is executed, Lessee shall execute and file with the Lessor a good and sufficient bond or other financial guarantee acceptable to Lessor in order to: (a) guarantee Lessee's performance of all covenants and obligations under this Lease, including Lessee's obligation to pay royalties; and (b) ensure compensation for damage, if any, to the surface estate and any surface improvements. The Lease Bond shall meet all federal mineral lease bond requirements as described in 43 Code of Federal Regulations Subpart 3474. The Lease Bond shall further provide that upon forfeiture after reversion of the Leased Premises to the United States, the Lease Bond shall be payable to the Secretary of the Interior.

8. Royalty Payment. After reversion of the Leased Premises to the United States pursuant to paragraph ___, Reversion of Leased Premises to United States, Lessee shall report production and royalties monthly in accordance with applicable federal regulations.

9. Federal Inspections. Lessee agrees that, prior to reversion of the Leased Premises to the United States, employees and authorized agents of the Bureau of Land Management ("BLM") may conduct underground inspections of the Leased Premises, both independently and in cooperation with the State in its capacity as Lessor. After reversion, employees and authorized agents of BLM may conduct underground inspections of the Leased Premises under the authority of applicable federal laws and regulations.

2. **Venting of Coalbed Methane for Safety Reasons.** In patents for coal tracts issued to SITLA pursuant to the Act, DOI reserved coalbed methane to the United States. Under certain circumstances, venting of coalbed methane may be necessary to ensure the safety of coal mining operations and/or compliance with safety regulations imposed by the U.S. Mine Safety and Health Administration ("MSHA"). DOI agrees that it will not unreasonably withhold consent to the venting of coalbed methane by SITLA's coal lessees as necessary for safety reasons and/or MSHA compliance. Such consent may be conditioned upon resolution of conflicts with existing federal oil and gas leases, payment of royalties for coalbed methane that is captured and used by the lessee, and other requirements that would not unreasonably interfere with coal mining operations.

3. **Consultation Concerning Potentially-Conflicting Uses.** In order to minimize conflicts with coal mining operations, DOI and USDA-Forest Service agree to consult with SITLA prior to issuance of federal leases and permits that have the potential to conflict with coal mining operations on coal tracts conveyed to SITLA pursuant to the Agreement, including but not limited to oil and gas leases and power line and utility easements.

4. **Confidentiality of Operator Data**. To the extent permissible by applicable federal law, DOI shall keep confidential geologic and business data obtained by it pursuant to its right under this MOU to conduct underground inspections of coal tracts that are subject to reversion to the United States under the Agreement.

5. **Mineral Leasing Act Acreage Limitations.** DOI recognizes and acknowledges that leases issued by SITLA on coal tracts that are subject to reversion to the United States under the Agreement do not constitute leases issued under the Mineral Leasing Act, 30 U.S.C. §§ 181 *et seq.* (the "MLA"). As such, the acreage within leases issued by SITLA shall not be considered by DOI in the calculation of lessee acreage limitations under the MLA upon reversion of the underlying tracts to the United States pursuant to the Agreement.

6. **Effect of Indemnity**. It is the understanding of SITLA that the general indemnity provisions contained in paragraph 16.1 of the proposed SITLA coal lease form for tracts in which the United States has a reversionary interest, as that paragraph of such lease form is attached hereto and incorporated by reference, extends to indemnification of the Lessor (including the United States as successor Lessor after reversion of the Leased Premises to the United States) for claims, demands, liabilities, damages and penalties incurred as a result of the Lessee's violation of applicable statutes, regulations and ordinances relating to public health, pollution control, management of hazardous substances and environmental protection, compliance with which is required pursuant to paragraph 9.3 of the proposed lease form (as such paragraph is also attached hereto and incorporated by reference).

7. **Transfer of Minimum Royalty Credit Balance at Reversion**. It is contemplated by the Parties that leases of coal tracts acquired by SITLA pursuant to the Act may require the coal lessee to pay minimum lease royalties to keep the respective leases in effect beyond the primary term, and that such minimum royalties will constitute a credit against future production royalties. The Parties further contemplate the possibility that, at the time certain tracts revert to the United States, the lessee may have paid to SITLA minimum royalties in an amount which would create a credit against production royalties accruing to the United States on production after reversion. In order to prevent loss to the United States in such event, SITLA agrees to pay to the United States any credit balance that exists in the minimum royalty account of any coal lease of the Mill Fork, Dugout, Muddy, or North Horn tracts at the time of reversion of that lease. SITLA shall pay such credit balance(s), without interest on accrued amounts, to the United States within ninety (90) days of the reversion. Nothing in this paragraph shall obligate SITLA to pay interest to the United States on minimum royalty amounts collected by it prior to reversion. In the event that any lease of the above-described tracts terminates or is canceled prior to reversion, SITLA shall be entitled to retain all minimum royalty amounts collected by it under that lease without obligation to the United States at the time of any future reversion. Nothing in this paragraph shall prevent SITLA from recouping or recovering from the State of Utah the State's proportionate share of previously collected and distributed minimum royalties that are required to be paid to the United States pursuant to this paragraph, or from reserving from distributions such amounts as are deemed necessary to meet SITLA's potential obligation under this paragraph.

8. **Effect of Amendment.** Except as expressly amended herein, the MOU is unamended and remains in full force and effect by and between the Parties.

IN WITNESS WHEREOF, the Parties have executed this First Amendment to the MOU.

FOR THE UNITED STATES DEPARTMENT OF THE INTERIOR

By: Sylvia V. Baca

Title: Acting Assistant Secretary

Date: MAR 23 1999

FOR THE UTAH SCHOOL AND INSTITUTIONAL TRUST LANDS ADMINISTRATION

By: David T Terry

Title: Director

Date:

FOR THE UNITED STATES DEPARTMENT OF AGRICULTURE

By: Anne Kennedy

Title: Deputy Under Secretary

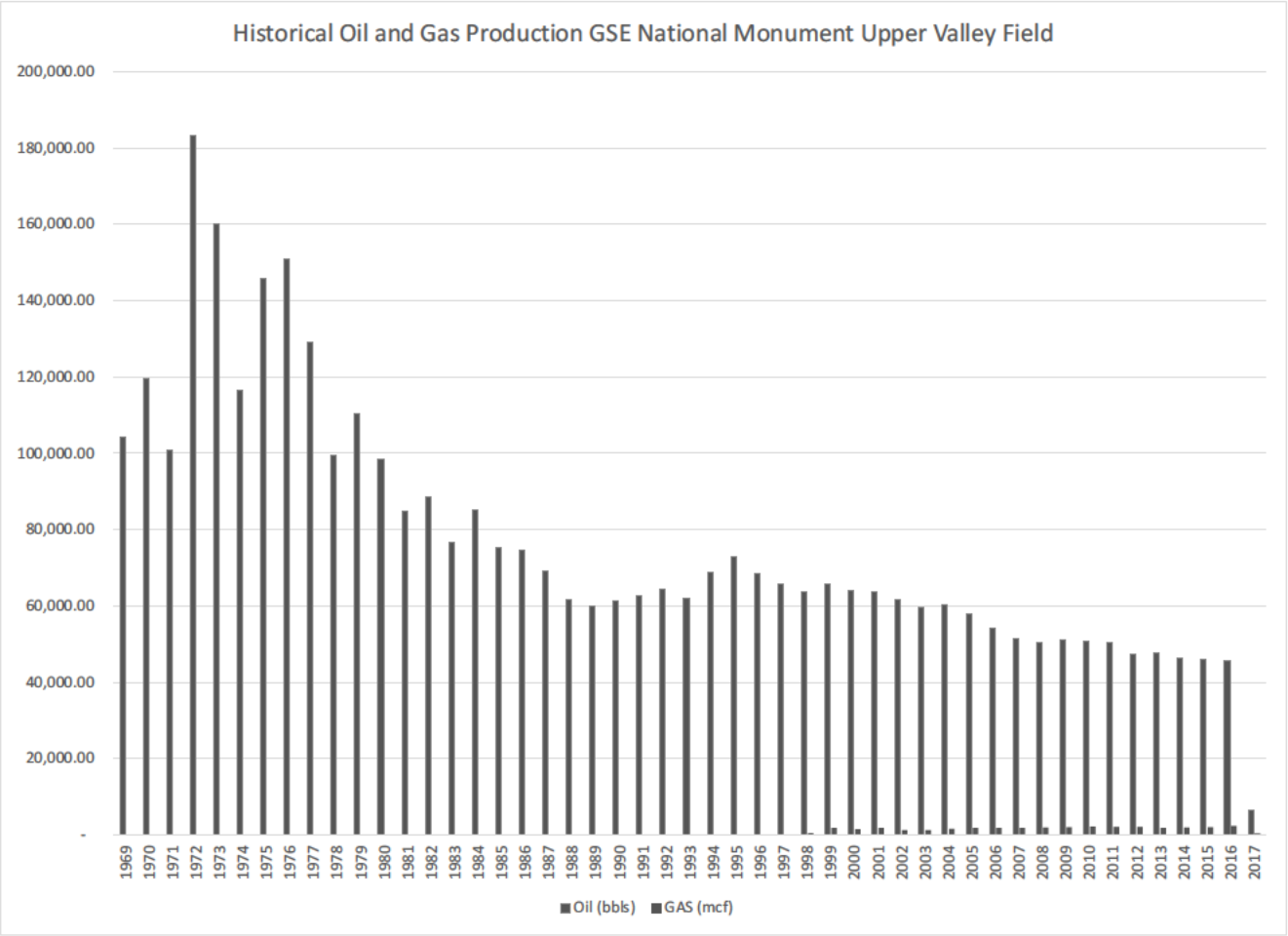
Date: 4-16-99

ATTACHMENT

SITLA Coal Lease Form Paragraphs 9.3 and 16.1

9.3 Other Applicable Laws and Regulations. Lessee shall comply with all applicable federal, state and local statutes, regulations, and ordinances, including without limitation the Utah Coal Mining and Reclamation Act, applicable statutes and regulations relating to mine safety and health, and applicable statutes, regulations and ordinances relating to public health, pollution control, management of hazardous substances and environmental protection.

16.1 Indemnity. Except as limited by paragraph 7.2, Inspection, Lessee shall indemnify and hold Lessor and the United States (as successor Lessor or owner pursuant to reversion or as owner of surface estate) harmless for, from and against each and every claim, demand, liability, loss, cost, damage and expense, including, without limitation, attorneys' fees and court costs, arising in any way out of Lessee's occupation and use of the Leased Premises, including without limitation claims for death, personal injury, property damage, and unpaid wages and benefits. Lessee further agrees to indemnify and hold Lessor harmless for, from and against all claims, demands, liabilities, damages and penalties arising out of any failure of Lessee to comply with any of Lessee's obligations under this Lease, including without limitation attorneys' fees and court costs.

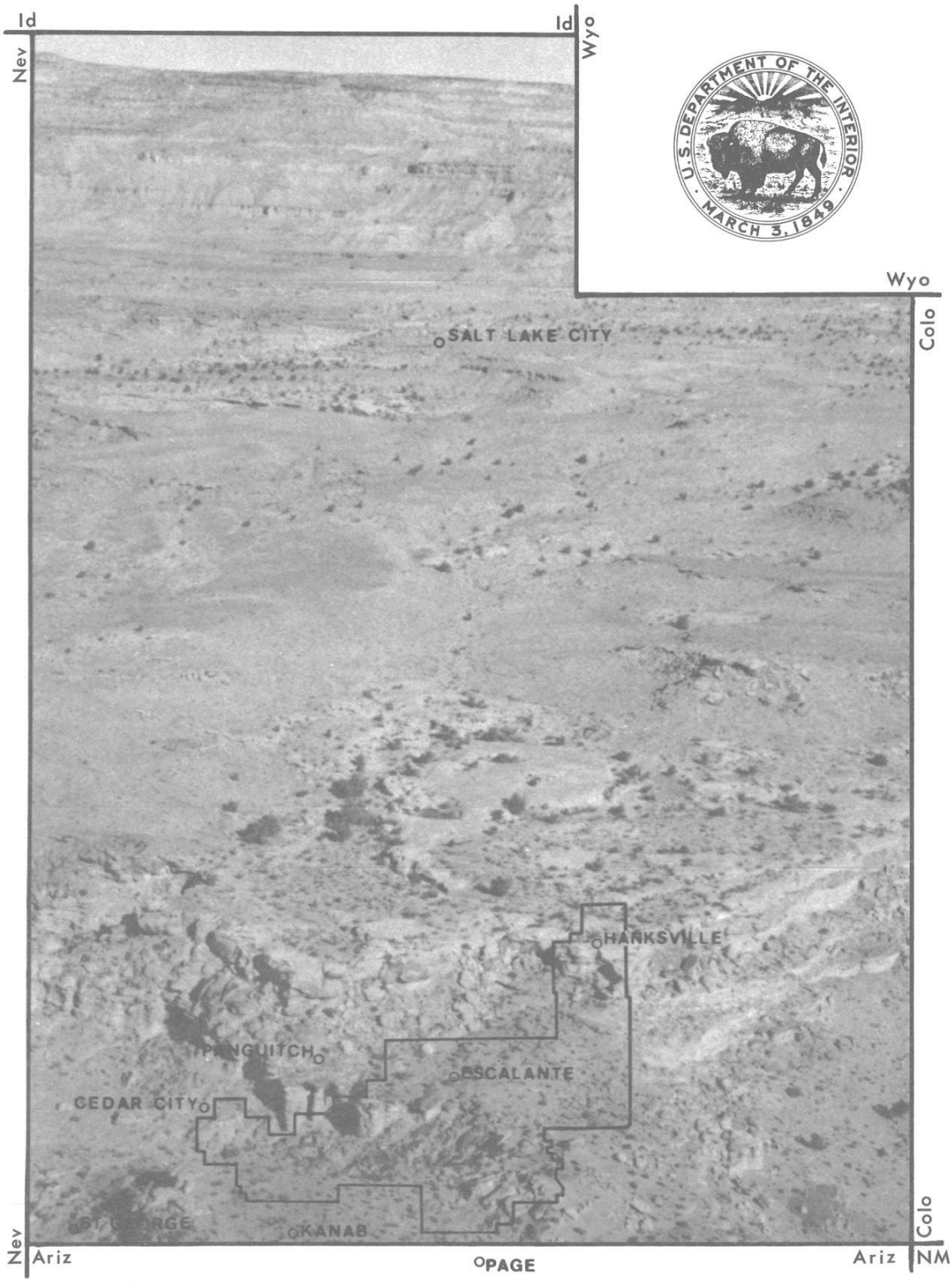


API	WELL_NAME	LOCATION_SURF_WCR	QTR_QTR	SECTION	RANGE	MERIDIAN	COUNTY	LEASE_NUM	LA_PA_DATE	TOTAL_CUM_OIL	TOTAL_CUM_GAS	TOTAL_CUM_WATER	UNIT_NAME	GIS_STAT_TYPE	COMPANY_NAME	ORIG_COMPL_DATE	ORIG_TD
4301710185	GOVT 2	0333 FNL 0293 FWL	NWNW	08	R02.0E	S	GARFIELD	SL-065689	10/26/1952	-	-	-		PA	CALIFORNIA OIL CO	10/26/1952	7114
4301730012	UV 18	2100 FSL 0200 FWL	NWSW	31	R02.0E	S	GARFIELD	U-019378		1,425,264.00	17,319.00	51,466,194.00	UPPER VALLEY	POW	CITATION OIL & GAS CORP	4/29/1969	7074
4301730013	UV 19	0360 FNL 0735 FWL	NWNW	06	R02.0E	S	GARFIELD	UTU 019378		200,505.00	-	6,907,106.00	UPPER VALLEY	WIW	CITATION OIL & GAS CORP	6/5/1969	7157
4301730015	UV 12	2085 FSL 0810 FWL	NWSW	06	R02.0E	S	GARFIELD	U-019378		462,321.00	4,788.00	19,108,187.00	UPPER VALLEY	SOW	CITATION OIL & GAS CORP	7/28/1969	7220
4301730021	UV 21	0775 FNL 0740 FWL	SWSW	07	R02.0E	S	GARFIELD	U-019379		332,176.00	5,600.00	7,156,439.00	UPPER VALLEY	POW	CITATION OIL & GAS CORP	2/23/1970	9951
4301730030	UPPER VALLEY U 23	2180 FNL 1645 FWL	SENW	30	R02.0E	S	GARFIELD	U-013734		-	-	-	UPPER VALLEY	WIW	CITATION OIL & GAS CORP	6/23/1971	6900
4301730039	UV 27	1540 FSL 1830 FEL	NWSE	07	R02.0E	S	GARFIELD	U-019379		322,964.00	5,437.00	6,645,860.00	UPPER VALLEY	POW	CITATION OIL & GAS CORP	11/29/1971	7315
4301730067	LITTLE VALLEY FED 1	1985 FNL 1965 FWL	SENW	18	R02.0E	S	GARFIELD	U-0128443		1,056,705.00	-	12,795,229.00		POW	CITATION OIL & GAS CORP	12/16/1974	7695
TOTAL										3,799,935.00	33,144.00	104,079,015.00					

RPT_Year	Oil (bbls)	GAS (mcf)	Water (bbls)
1969	104,218.00	-	543,646.00
1970	119,507.00	-	859,674.00
1971	100,917.00	-	1,011,394.00
1972	183,133.00	-	1,986,192.00
1973	160,275.00	-	2,114,010.00
1974	116,671.00	-	2,253,331.00
1975	145,772.00	-	2,151,529.00
1976	150,860.00	-	2,334,533.00
1977	129,073.00	-	2,499,352.00
1978	99,349.00	-	1,749,170.00
1979	110,172.00	-	2,255,569.00
1980	98,434.00	-	2,183,022.00
1981	84,900.00	-	1,885,062.00
1982	88,631.00	-	2,184,515.00
1983	76,616.00	-	2,196,750.00
1984	85,275.00	-	2,665,360.00
1985	75,286.00	-	2,283,594.00
1986	74,449.00	-	1,850,675.00
1987	69,177.00	-	1,762,112.00
1988	61,615.00	-	1,411,176.00
1989	59,800.00	-	1,655,753.00
1990	61,136.00	-	1,937,637.00
1991	62,582.00	-	2,000,266.00
1992	64,352.00	-	2,007,402.00
1993	61,880.00	-	2,106,751.00
1994	68,923.00	-	2,185,985.00
1995	72,830.00	-	2,216,784.00
1996	68,328.00	-	2,365,874.00
1997	65,828.00	-	2,222,047.00
1998	63,709.00	438.00	2,026,691.00
1999	65,864.00	1,742.00	2,263,879.00
2000	63,934.00	1,448.00	2,187,330.00
2001	63,824.00	1,813.00	2,256,954.00
2002	61,578.00	1,174.00	2,258,223.00
2003	59,636.00	1,168.00	2,298,116.00
2004	60,338.00	1,539.00	2,359,269.00
2005	57,856.00	1,812.00	2,376,104.00
2006	54,005.00	1,785.00	2,458,079.00
2007	51,423.00	1,756.00	2,576,723.00
2008	50,409.00	1,885.00	2,558,164.00
2009	50,969.00	2,010.00	2,488,256.00
2010	50,622.00	2,120.00	2,446,403.00
2011	50,401.00	2,063.00	2,609,873.00
2012	47,338.00	2,063.00	2,618,375.00
2013	47,681.00	1,828.00	2,643,448.00
2014	46,337.00	1,852.00	2,515,483.00
2015	45,910.00	1,955.00	2,409,415.00
2016	45,538.00	2,357.00	2,324,769.00
2017	6,570.00	336.00	334,110.00
	3,763,931.00	33,144.00	102,888,829.00

Development of Coal Resources in Southern Utah
Part I Regional Analysis

FINAL ENVIRONMENTAL STATEMENT



otograph: View of the southern part of the Kaiparowits Plateau, looking north toward Fourmile Bench.

ENGLISH-METRIC CONVERSION FACTORS

	Multiply by	To obtain Metric unit
------	2.54	Centimeters (cm).
------	3.048×10^{1}	Centimeters (cm).
------	3.048×10^{-1}	Meters (m).
------	1.609	Kilometers (km).
------	9.290×10^{-2}	Square meters (m^2).
------	4.047×10^{-1}	Hectares (ha).
------	4.047×10^{-3}	Square kilometers (km^2).
)------	1.233×10^{3}	Cubic meters (m^3).
	1.233×10^{-3}	Cubic hectometers (hm^3).
------	7.646×10^{-1}	Cubic meters (m^3).
------	4.536×10^{-1}	Kilograms (kg).
------	9.072×10^{-1}	Metric tons (t).
b/acre)	1.12	Kilograms per hectare (kg/ha).
------	2.326	Kilojoules per kilogram (kJ/kg).
------	3.785×10^{-3}	Cubic meters (m^3).
------	6.309×10^{-2}	Liters per second (L/s).
°F)--	(1)	Degrees Celsius (°C).

=(temperature in °F - 32)/1.8.

Gordon Whitney

FINAL

ENVIRONMENTAL STATEMENT

DEVELOPMENT OF COAL RESOURCES

IN

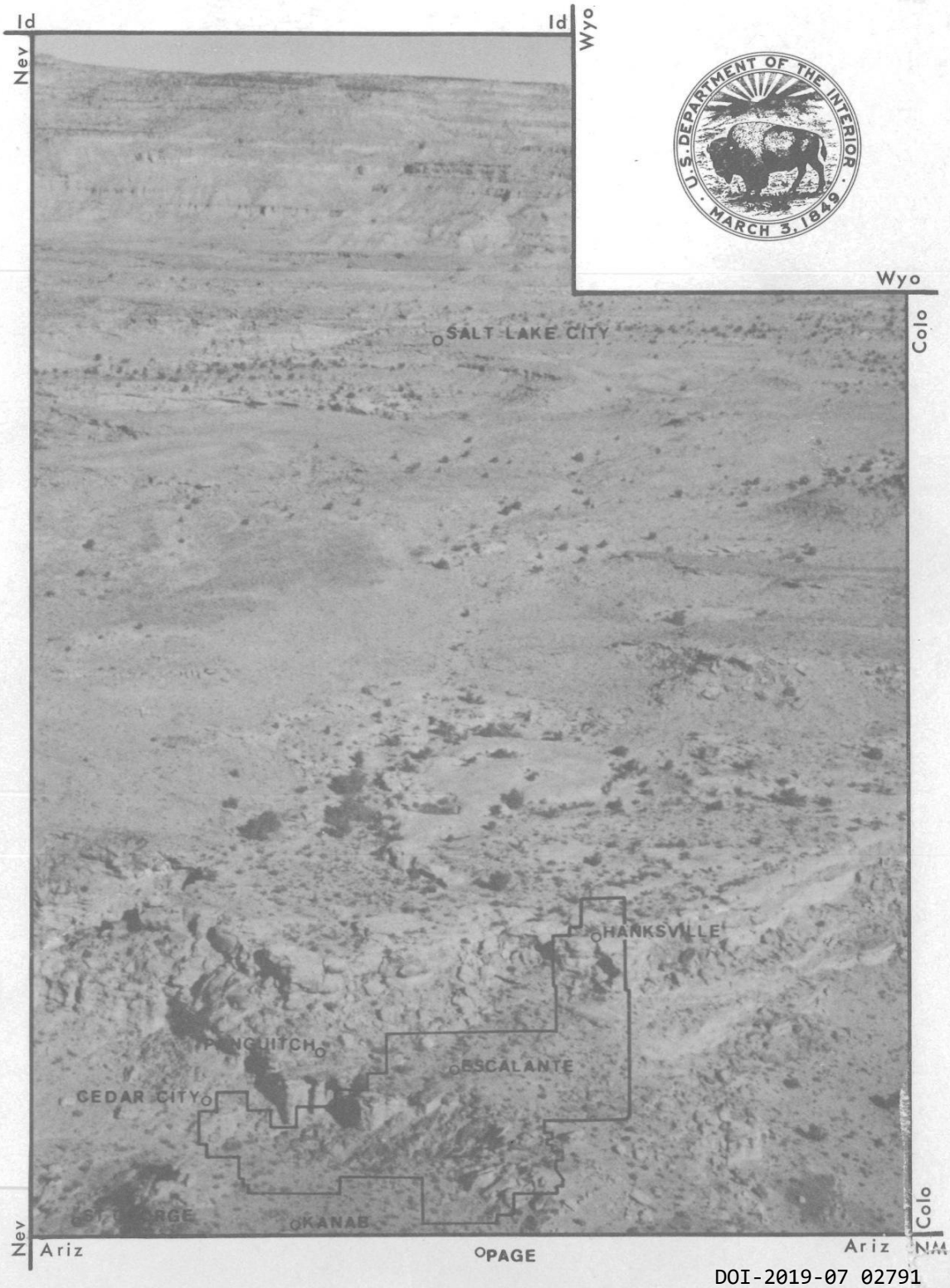
SOUTHERN UTAH

Prepared by the

DEPARTMENT OF THE INTERIOR

D[illegible]ent of Coal Resources in [illegible]outhern Utah
Part 2 Site Specific Analysis

FINAL ENVIRONMENTAL STATEMENT



Cover photograph: View of the southern part of the Kaiparowits Plateau, looking north toward Fourmile Bench.

FINAL

ENVIRONMENTAL STATEMENT

DEVELOPMENT OF COAL RESOURCES IN SOUTHERN UTAH

Prepared by the

DEPARTMENT OF THE INTERIOR

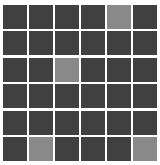
H. William Menard

Director, U.S. Geological Survey

1979

Trust Lands Administration

State of Utah School and Institutional Trust Lands Administration



Trust Lands Administration

State of Utah School and Institutional Trust Lands Administration

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Fiscal Year 2013 Annual Report
July 1, 2012 — June 30, 2013

Message from the Director

Strong business leadership and prudent land stewardship practices marked a successful 2013 fiscal year for the Trust Lands Administration. The agency celebrated 20 years of oil and gas operations within the Drunkards Wash Unit on its West Price/ Ferron Block. Since 1994, oil and gas development within this unit has generated $140 million for the Permanent School Fund and other beneficiaries.

Also this fiscal year, our principal role in the completion of a complex multi-agency land exchange helped protect wildlife habitat and provide property for a significant portion of the Utah Department of Transportation's Mountain View Corridor project in Salt Lake County, while generating $6.6 million for the Permanent School Fund. In addition, the agency was instrumental in selling property in a collaborative effort that fulfilled mitigation requirements for three southern Utah airports impacted by the Utah prairie dog, a species listed as 'threatened' under the Federal Endangered Species Act.

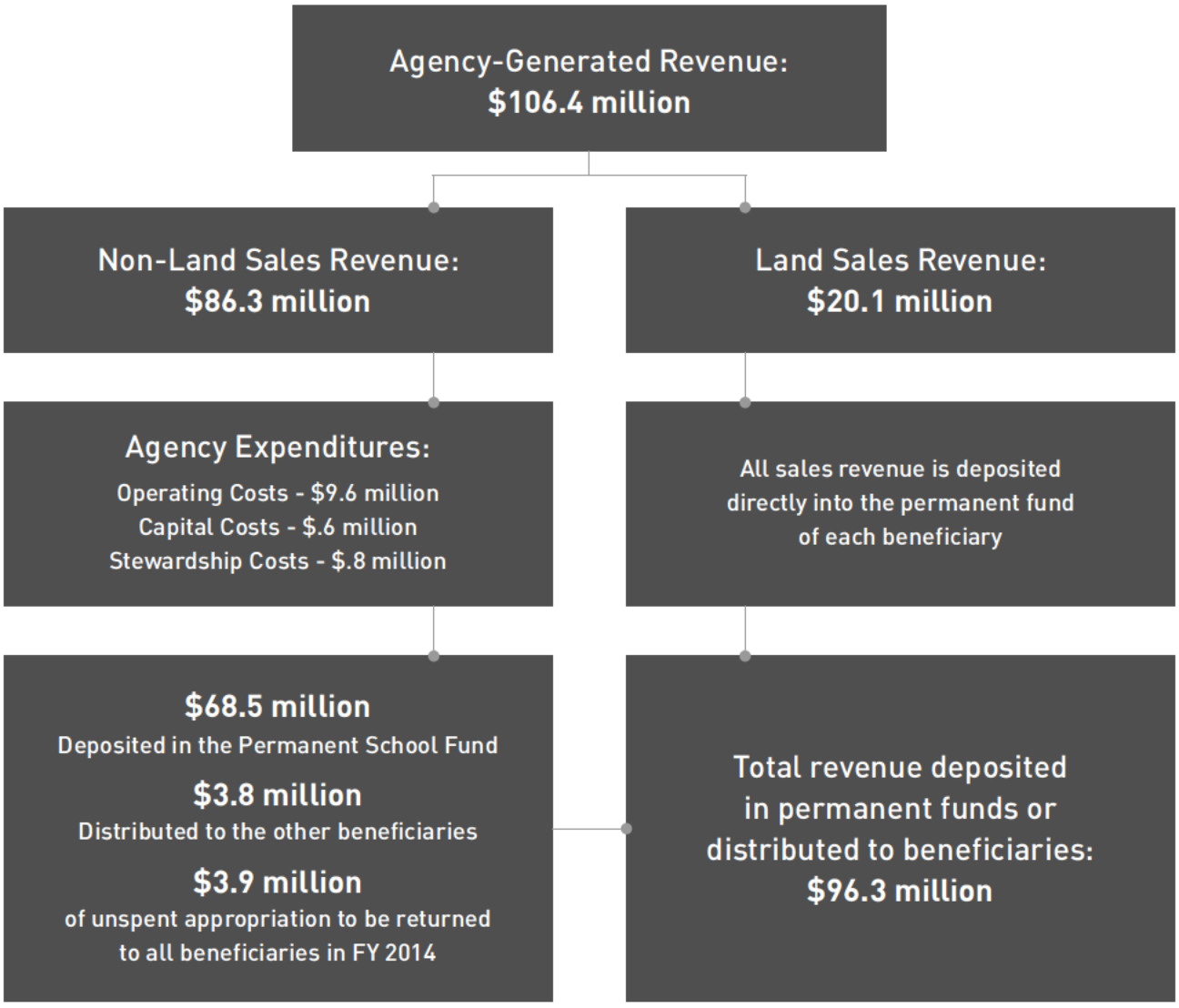
Also noteworthy is the significant increase in revenues produced by our Planning and Development Business Group. This year's performance exceeded the last four-year average earnings by approximately $9 million.

Total revenue from management and development of trust lands exceeded $106 million this year. The Permanent School Fund topped $1.6 billion during this fiscal year, providing nearly $40 million to K-12 schools and supporting critical academic programs identified by individual School Community Councils. Another $3.8 million was distributed to 11 other beneficiaries.

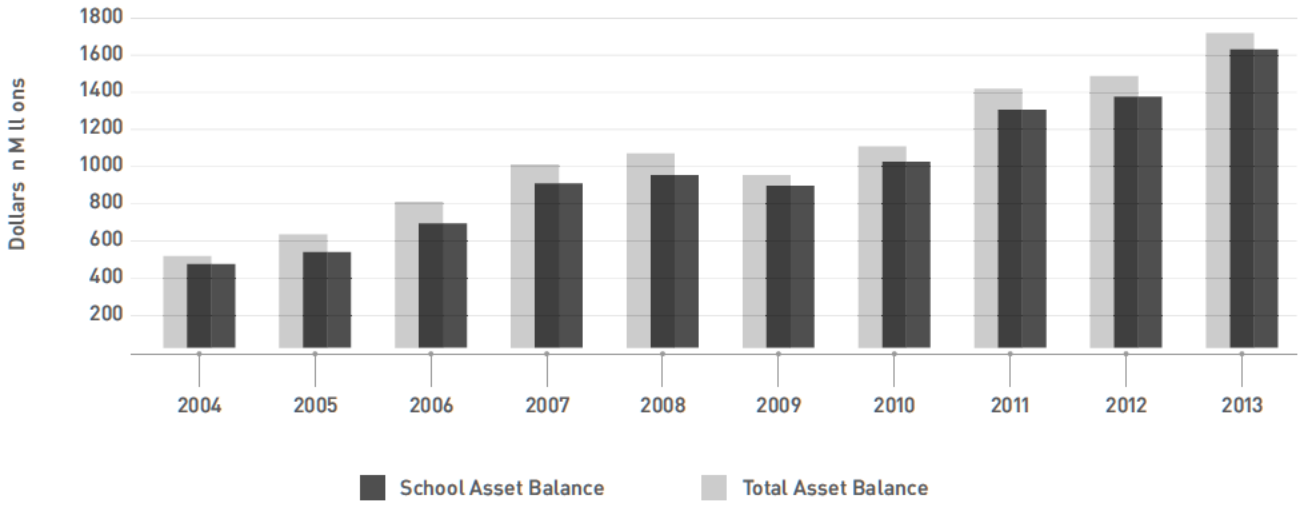
The accomplishments outlined in this year's annual report are due to the work of the agency's management team, its employees, and the Board of Trustees. I want to personally thank each of them for their professionalism, dedication, and efficiency in managing Utah's trust lands.

Kevin S. Carter

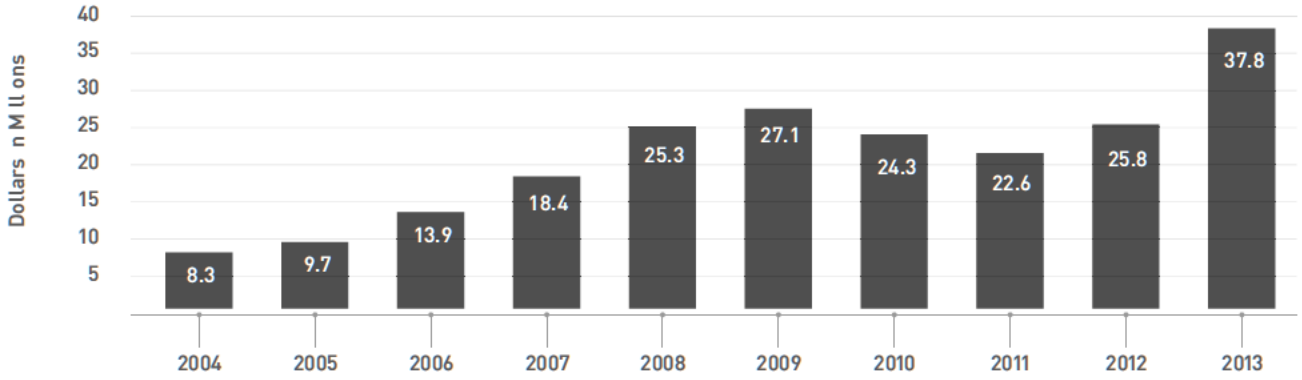
Cash Flow Fiscal Year 2013



Asset Value Fiscal Year 2004 — Fiscal Year 2013



Distributed to Schools 2004 — 2013



This financial information is unaudited.
Final audited information will be available online at trustlands.com by November 30, 2013.

2013 Fiscal Year Highlights

Mining Group

Oil Shale: The group competitively offered a 643-acre school section in Uintah County for oil shale lease. The parcel is strategically located and received a respectable bonus bid of $631,000, which is slightly more than $981 per acre. This successful lease demonstrates the importance of waiting for prime market conditions before offering select parcels for lease.

Coal: The Minerals Group successfully gained a contract presence in the Alton Coal Field. This exploration agreement includes an option to lease with Alton Coal Development, LLC., a pioneer in developing and mining southern Utah's vast coal resources.

Sand and Gravel: The group reported sand and gravel production gained a moderate increase of five percent over last fiscal year. Located primarily on trust lands in Vernal, Price, Moab, and St. George, aggregates are used in a variety of materials, almost exclusively within the construction industry.

Oil & Gas Group

Drunkards Wash Revenue: The Oil and Gas Group marked 20 years of ConocoPhillips operations within the Drunkards Wash Unit of the West Price/Ferron Block. Acquisition of additional land within this unit from the federal government, propelled oil and gas development into a position of providing stable, long-term revenues to the Permanent School Fund and other beneficiaries. The unit has and continues to provide revenue to the Division of Wildlife Resources for mitigation and ongoing wildlife studies in Carbon and Emery counties. Of the $700 million in gross revenues derived from oil and gas since 1994, $140 million originated from this unit.

Well Site Review: The group reviewed operations and reclamation at 2,592 well sites located on trust lands throughout Utah. Due to diligence, no environmental incidents have resulted in permanent damage.

Planning & Development Group

Staff reported revenues for 2013 improved substantially, ending the year at just under $14 million. Total revenue over the past four fiscal years averaged $4,514,700 annually as a result of the significant downturn in global and national real estate markets. However, signs of a positive, albeit slow, recovery began to appear in 2012.

Surface Group

State Interagency Land Exchange/Sale: Staff completed an interagency land swap with the Division of Wildlife Resources (DWR) and Utah Department of Transportation (UDOT) that earned $6.6 million for the Permanent School Fund. The agency traded 7,000 acres of unusable lands located within Wildlife Management Areas to DWR in exchange for a parcel at 5600 West 2100 South in Salt Lake County, which was then sold to UDOT to secure a one-mile section for the Mountain View Corridor.

Protected Species Mitigation: The Surface Group helped local, federal, and private agencies protect habitat for the federally threatened Utah prairie dog. The sale of 800 acres of prairie dog habitat in Garfield County to The Nature Conservancy, fulfilled mitigation requirements for the loss of habitat at three airports in Iron and Wayne counties. The mitigation funds of $800,000 from the Federal Aviation Administration used for the sale were deposited into the Permanent School Fund.

Wildfire Reclamation: The group reported an unusually severe year for wildfires throughout Utah. Seven of the 12 fires affecting trust lands were significant, burning 6,148 acres, which required rehabilitation to protect watersheds and other values. The agency is an active partner in Utah's Watershed Restoration Initiative (UWRI), which is instrumental in mobilizing collaborative fire restoration projects. Trust Lands spent $450,000 to seed affected acreage, and were supported by an additional $318,000 from other UWRI partners to meet additional seed, labor, and equipment expenses to complete fire rehabilitation work.

Renewable Energy Projects – Solar: The Surface Group noted an increased interest in renewable energy development, particularly solar energy, on trust lands this year. The largest and most significant project was a 300-megawatt photovoltaic solar development project on 1,754 acres of trust lands near the Intermountain Power Project plant in Millard County. When complete, it will be one of the largest solar energy projects in the country. This project and two smaller solar leases in Beaver and San Juan counties are expected to bring significant revenue to the Permanent School Fund through lease rental and royalty payments.

LaSal Off-Highway Vehicle Pilot Project: The agency completed a 135-mile off-highway vehicle (OHV) trail system on 28,000 acres in the La Sal Mountains. Trust Lands led several public meetings involving officials from Grand and San Juan counties, and representatives from the Divisions of Wildlife Resources and State Parks, and off-roading groups. Funds for the project came from a $1.50 surcharge on all OHV registrations. This collaborative project successfully curbed historic resource degradation caused by undisciplined OHV use on two of the agency's premier land blocks.

Legitimizing County Road Claims: The Surface Group completed its sixth year of engaging with rural counties to legitimize county-claimed roads located on trust lands. Analysis is now complete for the final group of Class B and the first block of Class D roads. Efforts this year yielded 63.53 miles of roads perfected as easements and 199.28 miles of roads recognized as valid existing rights through formal disclaimers of interest. Our agency formalized a partnership with the Permanent Community Impact Fund Board, which will assist counties with road easement purchases and facilitate efficient completion of legitimizing remaining roads.

Audit Group

Audit staff recovered approximately $1.3 million in unpaid royalties by conducting revenue compliance reviews to determine if lessees properly reported commodity volumes. Following an audit schedule approved by the director, the group meets at various times throughout the year with the Board of Trustees Audit Committee.

Legal Group

The Legal Group supervised the successful completion of appraisals for the Utah Recreation Land Exchange Act (URLEA). Authorized by Congress in 2009, the URLEA exchange will convey 25,000 acres of trust lands in the scenic Colorado River corridor near Moab for 35,000 acres of federal land in the Uintah Basin that has considerably higher potential for oil and gas development. Closing of the exchange is expected to occur in early 2014.

Environmental Compliance: The Compliance Group increased lease reviews and inspections to insure lessees use best management practices and reduce the likelihood of exposing the agency to environmental liabilities, legal issues, and remediation costs. This proactive management strategy has and will continue to substantially reduce liability risks in the long term and promote good stewardship of the land.

Information Technology & Geographic Information Systems Group

The Technology Group successfully deployed a web-based GIS platform for online and mobile use. The new platform allows employees and others to view, query, and collect data on trust land parcels with hand-held devices. These tools increase productivity from field to office. ■

Senior Staff

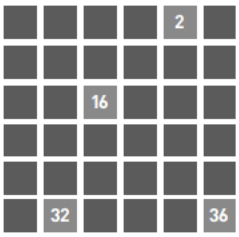
Kevin Carter, Director
John Andrews, Associate Director and Chief Legal Counsel
Kim Christy, Deputy Director/Surface and External Affairs
Lisa Schneider, Assistant Director/Finance
Douglas O. Buchi, Assistant Director/Planning and Development
LaVonne Garrison, Assistant Director/Oil and Gas
Tom Faddies, Assistant Director/Mining
Jeff Roe, ITS Director
Ron Carlson, Audit Manager
Nannette Johnson, Assistant to the Director and Board of Trustees

Board of Trustees

Daniel C. Lofgren, Chair
Steven B. Ostler, Vice Chair
David Ure, Member
Louie Cononelos, Member
James M. Lekas, Member
Michael Mower, Member
Thomas W. Bachtell, Member

Today, the Trust Lands Administration manages 3.4 million acres of land and an additional 1.1 million acres of mineral estate to benefit 12 state institutions, known as beneficiaries.

The School and Institutional Trust Lands Administration manages trust lands on behalf of and for the exclusive benefit of 12 state institutions designated by the U.S. Congress in 1894.



Trust land parcels allocated to the state.

At the time of statehood, Congress granted parcels of land to Utah from which revenue could be generated to support designated state institutions. These trust land parcels were allocated by apportioning the state into townships, each six by six miles, and dividing each township into 36 square-mile sections. Utah was given sections 2, 16, 32, and 36 in each township for public schools, resulting in a checkerboard of land ownership. All other designated state institutions were granted fixed amounts of acreage selected by the state from the remaining public domain.

More than one-half of the original land grant acreages were sold during the first 35 years of statehood. Interestingly, approximately 30 percent of all private land in Utah was originally trust land.

In 1994, realizing the revenue potential of trust lands for public schools and 11 other institutions, the Utah Legislature created the School and Institutional Trust Lands Administration as an independent agency to manage and develop trust land assets.

Institutions supported by the Trust Lands Administration

- Public schools
- Public buildings
- Miners Hospital at the University of Utah
- Reservoirs
- School of Mines
- School for the Blind
- School for the Deaf
- State Hospital
- University of Utah
- Utah State University
- Youth Development Center
- Teaching colleges at Dixie State, Southern Utah, Utah State, and Weber State universities, and the University of Utah

The Trust Lands Administration manages the land portfolio for each beneficiary, generating revenues through oil, gas, and mineral leases, rents, and royalties; real estate development and sales; and surface estate sales, leases, and easements. Revenues generated from each real estate portfolio are placed into individual trust funds, which are invested by the state treasurer. Income earned from each trust fund is distributed to its beneficiary.

Utah's public schools are the beneficiary of 96 percent of all trust lands. Revenue generated from school trust lands is transferred into the Permanent School Fund, growing the endowment for public schools. Income earned from the fund is distributed annually to individual school councils using a per-pupil formula.

Permanent funds for the 11 other beneficiaries grow more slowly because they hold a smaller percentage of lands, and only revenues from land sales are placed into their permanent funds. All remaining earnings are distributed annually to each beneficiary.

Since 1994, the Permanent School Fund has grown from $50 million to more than $1.6 billion.

The Trust Lands Administration is entirely self-funded with no taxpayer or general fund support. A portion of revenue generated from managing trust lands activity is used for operations and administration.

In addition to its land management mandate, the agency administers the Land Exchange Distribution Account. The Trust Lands Administration manages the complex disbursement of development royalties from federal lands, which serve as compensation to the 27 counties that acquired or exchanged lands at the time of Grand Staircase Escalante National Monument designation. The agency anticipates this responsibility will grow as it continues collaboration with the federal government on several land exchanges.

The Trust Lands Administration employs a team of business professionals who manage all facets of land management and administrative operations.

Oil and Gas: Leases trust lands for oil and gas exploration; works with the energy industry creating opportunities to generate short- and long-term revenues.

Mining: Leases trust lands to generate revenue from coal, oil shale, bitumen, potash, and phosphate; construction materials such as sand and gravel, rock aggregate, and high-quality limestone products; and copper, beryllium and uranium.

Surface: Leases surface rights for telecommunication, commercial, agricultural, and industrial purposes; issues easements, rights of entry, timber and grazing permits; conducts land sales and exchanges; and administers water rights.

Cultural Resource Management: Assists the entire agency in its compliance with Utah code requiring state agencies to consider the effects on historic and archaeological resources within project areas.

Planning and Development: Works with private real estate developers to provide residential, commercial, and industrial development in Utah's growing communities.

Information Technology and Geographic Information Systems (GIS): Provides expertise and service in the fields of information technology, GIS, spatial analysis, cartography, remote sensing, and aerial photography to staff and the public.

Legal: Provides legal counsel on all matters affecting the trust; drafts and reviews transactional documents, such as leases and joint ventures, for disposition of trust lands; represents the agency in litigation; and supervises the agency's law enforcement and environmental compliance activities.

Administrative Services: Provides professional administrative support in all areas, including: finance and auditing; human resources; and records management.

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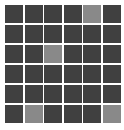
Trust Lands Administration

State of Utah School and Institutional
Trust Lands Administration

Our mission is to administer trust lands prudently and profitably for Utah's schoolchildren and other trust beneficiaries.



Trust Lands Administration

State of Utah School and Institutional
Trust Lands Administration

www.trustlands.com

Call for Data Related to Review of National Monuments under EO 13792 (April 26, 2017)

1. Information on activities permitted at the Monument, including annual levels of activity from the **date of designation to the present (Designation date for GSENM is September 18, 1996)**
   a. Energy - annual production of coal, oil, gas and renewables (if any) on site; amount of energy transmission infrastructure on site (if any)
      - The annual production of oil and gas in the Grand Staircase Escalante National Monument (GSENM) is currently occurring in or adjacent to the Upper Valley Unit (UVU) in the north-central area of the GSENM (Attachment Upper Valley Unit Map). Four wells within the GSENM are currently producing oil and a small amount of gas. The UVU was approved in 1962 and production from the wells peaked in 1972 at 183,133 bbls. In the last 20 years, 1997-2016, production has slowly declined from about 65,828 bbls oil and no gas annually to 45,538 bbls oil and 2357 mcf of gas. (Attachment: *Historical Oil and Gas Production GSE National Monument Upper Valley Field)*
      - No coal lands have been explored or coal produced within the GSENM since the September 18, 1996 declaration. Existing coal leases were cancelled in exchange for Federal payments totaling $42 million[1] (1/1/2017 $'s[2]).
      - Lands with an estimated 156.3 million tons of coal were exchanged to the State of Utah for State lands[3] in the GSENM with a current market value of $6.2 Billion and royalty value of $500 million. Tons remaining after the 156.3 million tons are produced, would revert to the Federal government.
      - Further, lands with an additional 45+ million tons[4] (market value $1.8 Billion and a royalty value of $144 million) will not revert to the Federal government until the State of Utah State Institutional Trust Lands (SITLA) receives $26,012,210 (plus interest) in royalty and rental.[5] As of 1 January 2017, the principal plus interest totaled $34.7 million[6]. Any tons of the 45+ million tons remaining after

[1] Attached: "GSENM Coal Lease Cancellation Payments"
[2] https://data.bls.gov/timeseries/WPU051?data_tool=XGtable
[3] Attached: "2017 Exchange Tract memo"
"MOU SITLA-BLM-FS Land Exchange Pub Law No 105-335 Stat 3139 ratified 8 May 1998"
[4] http://www.ecprogress.com/news/cottonwood-tract-out-for-lease/article_e165c9af-708a-5abb-b6a0-0180658ebaec.html
[5] Attached: "MOU SITLA-BLM-FS Land Exchange Pub Law No 105-335 Stat 3139 ratified 8 May 1998"
[6] Attached: "2017 Exchange Tract memo" – "Cottonwood Tract… Dollar value…" times two

the total of all payments are completed, revert to the Federal government

- At year-end 2016 the State had recovered 26.3 million tons[7] and received $57.2 million in payments[8] from the exchanged coal. The Federal government does not receive any revenue or compensation from those payments.
- BLM also provides mine inspection and technical advice to SITLA.[9]

b. Minerals - annual mineral production on site

- Mineral materials
  - No new Free Use and OTC permits issued since Monument designation. There were 8 Mineral Material Cases in the monument. A number of them were Free Use Permits granted to the county.
  - Valid existing permits, including those in Title 23 (3 Federal Highway Rights of Way), continue to be in effect
    According to UGS Circular 93, January 1997, "A Preliminary Assessment of Energy and Mineral Resources within the Grand Staircase-Escalante National Monument", there were five small mining operations on unpatented mining claims, four of which were active alabaster quarries and one, a suspended operation for petrified wood. Annual production of the alabaster was about 300 tons worth $500 per ton ($150.000/yr.). The decision to close the claims due to missing the filing date was upheld by IBLA in March of 2008. Since that time there has been no mining law operations within the monument.

3. Information on activities occurring during the **5 years prior to designation**

a. Energy - annual production of coal, oil, gas and renewables (if any) on site; amount of energy transmission infrastructure on site (if any)

- From 1992 until 1996, 336,313 bbls of oil and no gas was produced in the GSENM (Attachment: *Historical Oil and Gas Production GSE National Monument Upper Valley Field)*.
  - No coal was produced from the GSENM in the prior 5 years. However, exploration activities and planning for mining continued

[7] Attached: "2017 Exchange Tract memo"
[8] Attached: "A Bedingfield to J McKenzie 16 May 2017"
[9] Attached: "MOU SITLA-BLM-FS Land Exchange Pub Law No 105-335 Stat 3139 ratified 8 May 1998"

from the 1980's until the monument declaration.

- 700+ exploration drill holes were completed
- 64 Coal leases with some 168,000 acres were committed
- An electrical energy facility was evaluated and proposed in the 1960's[10]
- A regional EIS for mining was completed[11]
- A major coal mine was planned as described in 1994[12]

Grand Staircase-Escalante National Monument Existing Rights-of-Way/Permits/Authorized 09/25/1996 – 05/15/2017	
Existing Withdrawals: PSR, PWR, Bureau of Reclamation, Forest Service Wilderness, Power Site, National Park Service, In Trust for Indians,	17
Road ROWs	19
Misc. Roads & Associated Uses - Sec 107 Federal Aid Hwy, RS2477, Mineral Material Sites	0
Power Transmission Lines & Power Facilities	20
Communication Sites – Telephone, Telegraph, Radio Transmission, Global Positioning Systems	15
Water ROWs, Irrigation Facilities	14
Oil & Gas Pipelines, Oil & Gas Facilities	5
Other FLPMA ROWs, Perpetual Easements, Federal Facilities	2
Airport	0
Permit - 302 FLPMA – Misc.	0
Permits Film - 302 FLPMA (popular location (closed))	54

b. Minerals - annual mineral production on site

As far as mining law operations (3809), the alabaster quarries were the only authorized operation (06/30/1986) in the area prior to designation.

4. Information on activities that likely would have occurred annually from the date of designation to the present **if the Monument had not been designated**

The answers to this question would be highly speculative and is best answered with qualitative (rather than quantitative) data. As GSENM was designated 20 years ago,

[10] http://www.hcn.org/issues/16/492
[11] Attached Title Pages: "FINAL EIS - Dev of Coal Resources in Southern Utah Part 1 Regional"
[12]http://www.hcn.org/issues/16/492

the factors affecting such projections are subject to a wide range of variables (many of which are outside of BLM's purview, such as market prices).

a. Energy - annual production of coal, oil, gas and renewables (if any) on site; amount of energy transmission infrastructure on site (if any)
    - Except for the Upper Valley Field, there have been no oil and gas discoveries within the GSENM. Forty-seven exploratory wells have been drilled; an average of 57 square miles per well (Attachment: M. Lee Allison, page iv). An Application to Drill was submitted for valid existing leases within the Circle Cliffs Unit, but was never approved and the lessee allowed the leases to terminate. Had the GSENM not hindered exploration, there possibly would have been more discover and development Since there have been no discoveries upon which to base production numbers, estimates of the value of production vary widely. In January 1997, it was speculated that total value of Coal-bed gas and petroleum within the GSENM ranged between 2.02 and 18.6 billion dollars (Attachment: M. Lee Allison, page ii). The report from which these estimates were derived was the basis for a land swap of the Utah State Institutional Trust Lands within the GSENM and BLM administered lands within Drunkards Wash in Carbon County. Drunkards Wash has more than 400 producing wells and which by 2013 had generated $140 million dollars in royalties for the agency (Attachment *Trust Lands Administration Fiscal Year 2013 Annual Repor*t).
    - Coal Energy would have been produced and marketed as demonstrated by the ongoing Alton coal mine producing from private fee lands. As market conditions allowed, development of relatively remote and isolated areas of Utah would have proceeded providing employment and housing. State and County revenues would have increased significantly and Federal expenditures to exchange for the GSENM world-class coal resources would have been saved. State energy exports would have increased significantly. Recent advances in underground coal mining techniques would have been applied opening up additional large areas of Kaiparowits coal resources not considered minable in the 1990's.
    - The underground mining methods would have had little or very limited impact on tourism activities. The limited surface mining would have been properly reclaimed after the short-term use of the land. Clean world coal energy production would have benefitted from additional underground production within a setting of strict environmental regulation and enforcement.

Grand Staircase-Escalante National Monument Existing Rights-of-Way/Permits/All Dispositions Authorized/Closed/Relinquished/Withdrawn/Expired/Terminated/Cancelled/Pending/Rejected/Void 01/01/1991 – 09/24/1996 (In March 1999, BLM added Case Recordation components to the LR2000 Database System; therefore, some of the pre-LR2000 data may remain in the Status Database)	
Existing Withdrawals: PSR, PWR, Bureau of Reclamation, Forest Service Wilderness, Power Site, National Park Service, In Trust for Indians,	1
Roads ROWs	8
Misc. Roads - Sec 107 Federal Aid Hwy, RS2477, Mineral Material Sites	1
Power Transmission Lines & Power Facilities	1
Communication Sites – Telephone, Telegraph, Radio Transmission, Global Positioning Systems	1
Water ROWs, Irrigation Facilities	0
Oil & Gas Pipelines, Oil & Gas Facilities	2
Other FLPMA ROWs, Perpetual Easements, Federal Facilities	6
Airport	0
Permit - 302 FLPMA – Misc.	25
Permits Film - 302 FLPMA (popular location (closed))	0

b. Minerals - annual mineral production on site

According to the same UGS report referenced above concerning the alabaster quarries, "Over a 30-year period, the quarries should generate $4.5 million in production."

Although there were initially 79 mining claims within the monument at its designation, the only ones with an active operation were the alabaster quarries mentioned in the UGS report.

Furthermore, the UGS mineral report stated, "Various types of metallic-mineral deposits are known to be present in the monument (figure 14). Most of these are small and low-grade with uncertain likelihood of significant development." The UGS report addressed specific minerals with known or potential deposits within the monument, but they determined at that time they were probably not commercial quality due to low, often sub-economic grades and limited tonnage.

I would suspect that the alabaster operation would have continued, if the designation was not in place at the time they miss-filed their mining claim paperwork, they would have only had to re-locate the claims.

There would most likely be Mineral Material sites for sand and gravel and the Free Use Permits granted to Kane County would most likely still be in-use. This is a relatively small amount of material, but it is for the convenience of the county and the public to use.

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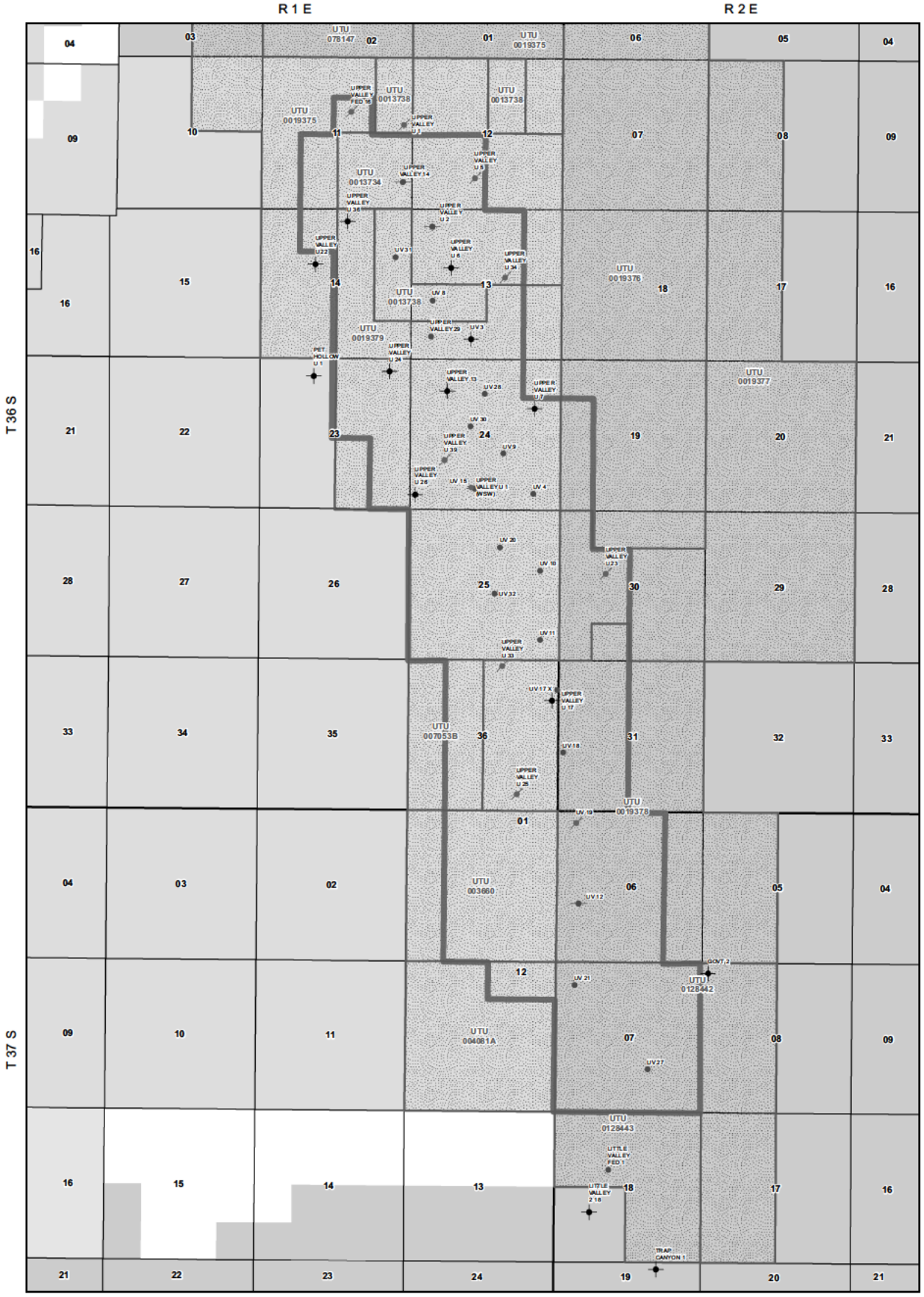
Upper Valley Field



Oil and Gas Unit Agreements

UPPER VALLEY

Utah Oil & Gas Lease Parcels

Authorized

Pending

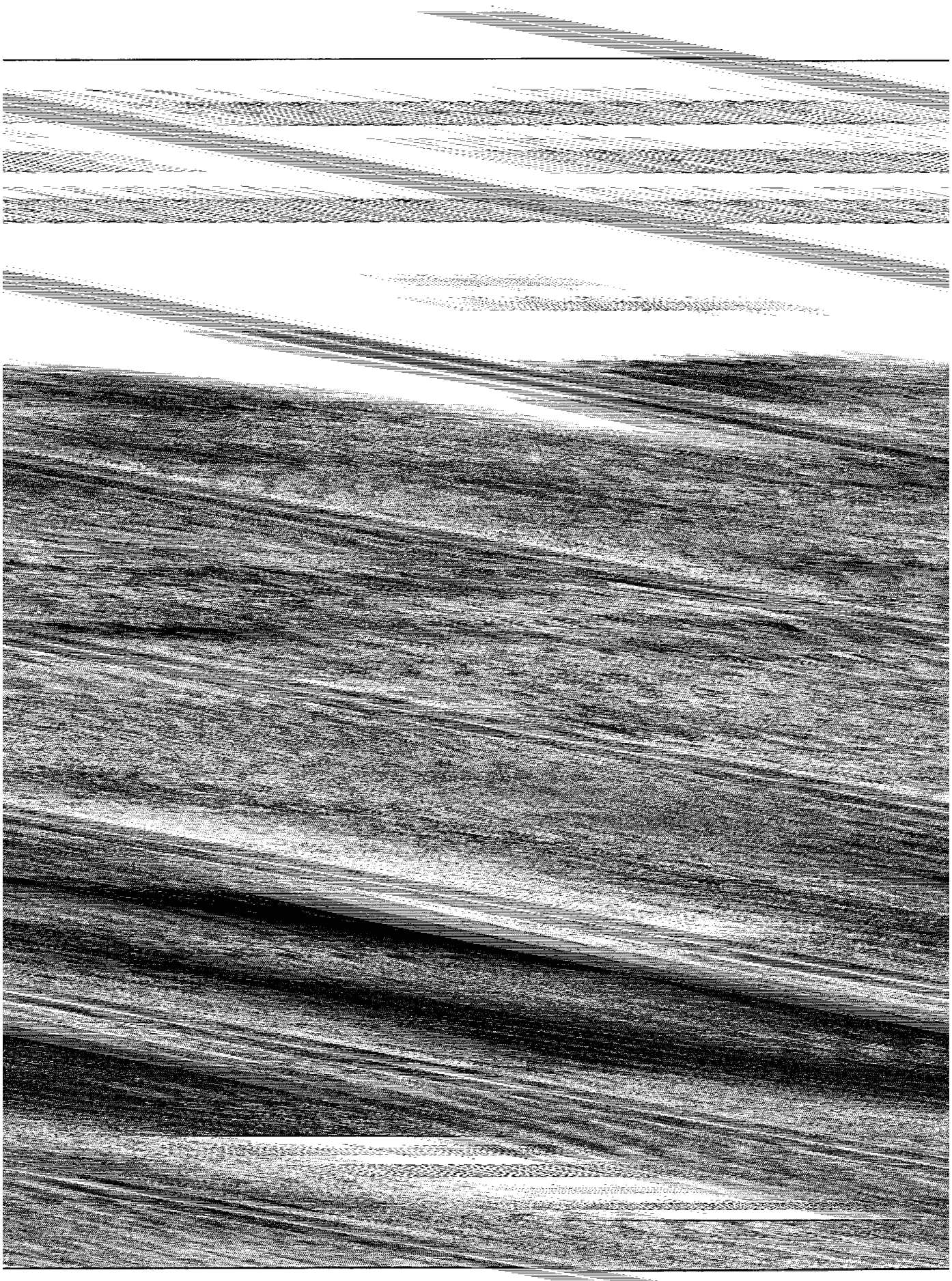
Oil & Gas Wells UDOGM

0 0.2 0.4 0.6 0.8 1

Miles

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data.

DOI-2019-07 02814



Cover Photo: A 15-foot-thick coal seam exposed in Warm Creek Canyon, Smoky Mountain area, Kaiparowits Plateau coal field. A coal seam 6 to 7 feet thick is reportedly buried by the rubble above the exposed seam (photo taken in November 1971; from Doelling and Graham, 1972).

A Preliminary Assessment of Energy and Mineral Resources within the Grand Staircase - Escalante National Monument

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Circular 93 **January 1997**
UTAH GEOLOGICAL SURVEY
a division of
Utah Department of Natural Resources

Note: *Look for additional information about the Grand Staircase - Escalante National Monument on the UGS home page - http://utstdpwww.state.ut.us/~ugs*

UTAH GEOLOGICAL SURVEY

The **UTAH GEOLOGICAL SURVEY** is organized into five geologic programs with Administration, Editorial, and Computer Resources providing necessary support to the programs. The **ECONOMIC GEOLOGY PROGRAM** undertakes studies to identify coal, geothermal, uranium, hydrocarbon, and industrial and metallic resources; initiates detailed studies of these resources including mining district and field studies; develops computerized resource data bases, to answer state, federal, and industry requests for information; and encourages the prudent development of Utah's geologic resources. The **APPLIED GEOLOGY PROGRAM** responds to requests from local and state governmental entities for engineering-geologic and ground-water investigations; and identifies, documents, and interprets Utah's geologic hazards and ground-water resources. The **GEOLOGIC MAPPING PROGRAM** maps the bedrock and surficial geology of the state at a regional scale by county and at a more detailed scale by quadrangle. The **GEOLOGIC EXTENSION SERVICE** answers inquiries from the public and provides information about Utah's geology in a non-technical format. The **PALEONTOLOGY AND PALEOECOLOGY PROGRAM** maintains and publishes records of Utah's fossil resources, provides paleontological recovery services to state and local governments, and conducts studies of environmental change to aid resource management.

The UGS Library is open to the public and contains many reference works on Utah geology and many unpublished documents on aspects of Utah geology by UGS staff and others. The UGS has several computer data bases with information on mineral and energy resources, geologic hazards, stratigraphic sections, and bibliographic references. Most files may be viewed by using the UGS Library. The UGS also manages a sample library which contains core, cuttings, and soil samples from mineral and petroleum drill holes and engineering geology investigations. Samples may be viewed at the Sample Library or requested as a loan for outside study.

The UGS publishes the results of its investigations in the form of maps, reports, and compilations of data that are accessible to the public. For information on UGS publications, contact the Department of Natural Resources Bookstore, 1594 W. North Temple, Salt Lake City, Utah 84116, (801) 537-3320.

10/96

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PREFACE

The purpose of this report is to provide a preliminary assessment of the energy and mineral resources in the newly created Grand Staircase - Escalante National Monument for two principal reasons. First, President Clinton directed the Bureau of Land Management to develop a management plan for the monument during the next three years. Information on the location, extent, size, and quality of various energy and mineral deposits needs to be available to the monument planners and the interested public to help determine how these resources will be incorporated into the management plan.

Second, about 176,000 acres of surface lands managed by the School and Institutional Trust Lands Administration (SITLA) for the benefit of Utah's school children are within the monument's boundaries and contain significant amounts of coal and other resources. The President, in proclaiming the monument's creation, promised to trade out the School Trust lands for comparable federal lands elsewhere, presumably in Utah. The Utah Geological Survey (UGS), hopes to conduct an inventory of resources on School Trust lands in the monument.

The summary information in this report gives what we believe is a reasonable initial overview of each of the different commodities present, although the amount and quality of data for each commodity varies. Do we have enough data for an in-holdings exchange to take place or even for an appraisal at this time? Probably not, if we need to be assured that the state gets fair and adequate compensation for its resources. An example using coal resources demonstrates just how accurate the assessment needs to be. Of the 62 billion tons of coal in the Kaiparowits coal field (which lies almost entirely within the monument) we calculate that at least 11.3 billion tons is recoverable. A one-percent increase in our coal recovery estimate amounts to more than 100 million tons of coal. At the current average price of $19.50 per ton of coal, the additional coal is worth nearly $2 billion, of which about $160 million in royalties would be paid.

Our preliminary calculation of recoverable coal on School Trust lands is 876 million tons. Each one-per cent change in our determination of recoverable coal on School Trust lands amounts to $170 million in value, worth nearly $14 million in royalties to the School Trust fund. Because we were so conservative in our calculations, the actual recoverable coal in the monument might be 50 percent higher than our base estimate, perhaps 16 billion tons in the monument, 1.3 billion tons on School Trust lands. **The value of the recoverable coal on School Trust lands is at least $17 billion but could be $25 billion or more. Royalties to the School Trust fund thus could be from $1.4 billion to over $2 billion.**

In order to adequately assess the recoverable coal resources on the School Trust lands in the monument, a team of geologists and mining engineers needs to prepare the equivalent of a operational mine plan for the entire Kaiparowits coal field. This would be a major effort requiring the team to map the continuity of each coal seam, determine lateral variations in thickness and vertical separation from other minable horizons, and to develop a plan that optimizes coal recovery. Given the massive size of the coal reserves and number of coal seams, we estimate such an undertaking could take a score of engineers and geologists three years to complete. However expensive that may seem, it's important to recognize that the entire cost of fully evaluating the potential of School Trust lands would be less than the additional royalties gained from a fraction of one percent increase in the amount of recoverable coal on School Trust lands.

Deposits of coal-bed gas, oil and gas, and alabaster are currently being developed inside the monument or appear to have strong potential to be developed. **The value of the known and potential energy and mineral resources of the Grand Staircase - Escalante National Monument at today's prices is between $223 billion and $330 billion.** This figure does not include values for tar sands, carbon dioxide reserves, or any of the other mineral deposits such as titanium, zirconium, uranium, or copper.

Coal	$221 billion - $312 billion
Coal-bed gas	$2 billion - $17.5 billion
Petroleum	$20 million - $1.1 billion
Minerals	$4.5 million - unknown

In our view, it is imperative that a detailed, combined geologic-engineering evaluation be conducted of the coal and other resources in the monument to ensure fair compensation for Utah's children. Without this, we risk leaving tens of millions of dollars of the children's money on the negotiating table. With it, we may be able to greatly enrich and protect their legacy.

M. Lee Allison
January 1997

SUMMARY

Since the designation of the Grand Staircase - Escalante National Monument by President Clinton on September 18, 1996, unresolved issues regarding the mineral value of state and federal lands within the monument have come to the forefront of debates. The monument extends across 1.7 million acres in Kane and Garfield Counties, Utah, and includes some of the most energy-rich lands in the lower 48 states. The U.S. Bureau of Land Management (BLM), the agency assigned to manage the monument, recently has begun a three-year program to formulate a management plan. Part of the management plan will likely focus on the disposition of more than 176,000 acres of Utah School and Institutional Trust Lands that are now monument in-holdings. SITLA controls mineral rights on more than 200,000 acres.

During President Clinton's proclamation speech, he addressed the issue of lands within the monument belonging to the school children of Utah. He stated to the effect that Utah's school children would not be denied the value held within these lands. Moreover, he directed the Interior Secretary to quickly move to trade the Utah School Trust lands within the monument for other federal lands or resources in Utah that are of comparable value. With the creation of the monument, mineral lands may have been effectively removed from consideration for mining, oil and gas exploration, etc. The purpose of this report is to review the present understanding of energy and mineral resources within the monument, qualitatively describe the resource potential for each known commodity, and propose plans to better assess these potential resources in order to help assure that Utah's school children receive fair and just compensation.

Coal in the Kaiparowits Plateau

The main mineral-resource issue is the enclosing of the Kaiparowits Plateau coal field within the monument boundary. The coal field is the largest in Utah, containing over 62 billion tons of coal in place (Hettinger and others, 1996). Using a resource assessment recently completed by the U.S. Geological Survey (USGS) and excluding resources considered unminable, the Utah Geological Survey (UGS) estimates that at a minimum, 11.36 billion tons of the coal resource are technologically recoverable from the entire field. Of this total, the UGS further estimated that some 870 million tons of this coal are technologically recoverable from Utah School Trust lands within the monument.

The Utah Office of Energy and Resource Planning (OERP) performed a preliminary valuation of coal lands in the monument and projected royalty and bonus bid revenues to the State of Utah and the Federal government. From this analysis, OERP determined that potential revenue to the State from recoverable coal could be $9.25 billion in present dollars over the life of mining. The U.S. Government would receive an equal amount. Revenue to the Utah School Trust could be an additional $1.54 billion. OERP also estimated that $65.15 million in present dollars could be realized as income by the State just from the proposed Smoky Hollow mine project of Andalex Resources over the proposed 30-year mine life. Of this total, OERP estimated that the Smoky Hollow project would have generated some $17.97 million in income to the State School Trust.

Coal-bed Gas

Most of the Kaiparowits Plateau coal field has potential for development of Coal-bed methane gas, even though no definitive studies have been done to date. Based on research in other Utah coal fields and extrapolating to the Kaiparowits field, the UGS estimates that the coal beds of the Straight Cliffs Formation contain between 2.6 and 10.5 trillion cubic feet of methane.

Oil and Gas Potential

The monument contains all the elements necessary for major oil and gas accumulations: source rocks, reservoirs, and trapping mechanisms. Commercial deposits of oil have been discovered both within and along the margins of the monument at Upper Valley field. Although the characteristics of the monument and Kaiparowits basin as a whole are favorable for the accumulation of oil and gas, wildcat density is extremely sparse. Only 47 exploratory wells have been drilled within the monument, or an average of 57 square miles per well. The postulated reasons for this apparent lack of exploratory activity are: (1) inaccessibility, (2) lack of oil and gas pipelines, (3) low success rates, (4) the collapse of world oil prices in 1986 and a nationwide oversupply of natural gas, and (5) environmental concerns and restrictions. Although the exploration risk is high, the monument could contain major accumulations of oil based on the

production history of Upper Valley field and geologic evidence.

Circle Cliffs Tar Sand

Solid hydrocarbons impregnate Triassic-age sandstone and siltstone along the flanks of the breached, Circle Cliffs anticline in the northeastern part of the monument. Known as tar sand, such deposits are essentially exhumed, fossil oil reservoirs where the lighter, more volatile fractions have been removed due to exposure. The entire west flank of the Circle Cliffs tar-sand deposit and a small part of the east flank is located in the monument. The remainder is within Capitol Reef National Park. Although there has been little recent commercial interest in extracting oil from the tar-sand deposits of the Circle Cliffs, researchers have estimated that as many as 550 million barrels of oil might be contained within tar sands of the monument.

Non-Fuel Minerals

Metallic mineral occurrences in the monument include gold, copper, manganese, titanium, zirconium, uranium, and vanadium. Most occurrences are small, low-grade, and have little development potential. Minerals such as titanium, zirconium, and vanadium, however, are considered "strategic and critical" and may have development potential within the monument. Uranium with associated copper plus trace amounts of cobalt occurs in the Shinarump Member of the Triassic Chinle Formation in the Circle Cliffs area of the northeastern section of the monument. About 75,000 pounds of U_3O_8 was reportedly produced from these deposits during the 1950s and 1960s. Vanadium associated with the uranium was produced as a byproduct. Anomalously radioactive outcrops of the Jurassic Morrison Formation have been noted on the east side of Fiftymile Mountain, suggesting the possibility that uranium minerals extend beneath the Kaiparowits Plateau.

Fossil, placer titanium-zirconium deposits occur in the Cretaceous Straight Cliffs Formation in a 40 to 50 mile-long-belt along the east side of the Kaiparowits Plateau. The deposits were never developed commercially because they are remote and because of problems associated with mining and beneficiation. However, the deposits are reportedly rich in rutile (titanium) and zircon (zirconium). Dow and Batty (1961) estimate that the aggregate size of 14 individual deposits is from 1 to 3 million tons of raw material.

Records obtained from the Utah Division of Oil, Gas and Mining indicate that five small mining operations are currently under permit in the monument. About 300 tons of alabaster, a fine-grained form of gypsum used for ornamental carvings, is quarried annually in four of these operations. The fifth is a suspended operation that mined petrified wood.

INTRODUCTION

Background

On September 18, 1996, by the authority vested through section 2 of the Antiquities Act of June 8, 1906 (34 Stat. 225, 16 U.S.C. 431), President Clinton established by proclamation the Grand Staircase-Escalante National Monument (Appendix A). The monument sets aside some 1.7 million acres, or about 2,700 square miles, in southern Utah to be protected for its scientific, historic, biologic, cultural, and scenic attributes. The proclamation cites examples of the attributes of the monument including: (1) exposed sedimentary rock layers that offer unobscured views of stratigraphy and geologic processes; (2) natural features like The Grand Staircase, White and Vermillion Cliffs, Paria Canyon, East Kaibab Monocline (The Cockscomb), Circle Cliffs, Waterpocket Fold, Escalante Natural Bridge, and Grosvenor Arch; (3) numerous archeological sites of the Anasazi and Fremont cultures; and (4) the variety of life zones from low-lying desert to coniferous forest.

Purpose and Scope

Since the establishment of the monument, issues regarding the mineral value of state and federal lands within the monument have come to the forefront of debates. The monument extends across 2,700 square miles in Kane and Garfield Counties, and includes the largest coal field in Utah. The monument also contains lands with probable oil and gas accumulations as well as other mineral commodities.

The BLM, the agency assigned to administer the monument, has begun a three-year program to formulate a management plan. Part of the management plan will likely focus on the disposition of nearly 176,000 acres of Utah School and Institutional Trust lands that are now within the monument. Recognizing their importance, President Clinton directed the Interior Secretary to act quickly to formulate plans to trade the Utah School Trust lands within the monument for other federal lands or resources in Utah that are of comparable value. The purpose of this report is to review the present understanding of energy and mineral resources within the monument, describe in general terms the resource potential for various commodities, and outline resource assessment objectives to help assure that Utah's school children receive fair and just compensation.

Location and Physiography

The monument is located within the Colorado Plateau physiographic province, near its western margin (figure 1). The Kaiparowits Plateau is centrally situated in the monument surrounded by the towns of Escalante, Henrieville, and Glen Canyon City. Doelling and Davis (1989) describe the region as characterized by a series of plateaus, buttes, and mesas that reflect the type and structure of the underlying geologic strata. The Grand Staircase is a broad feature which extends into the western half of the monument, and consists of a series of topographic benches and cliffs which, as its name implies, step progressively down in elevation from north to south. These step-like features include the Paria Terrace and the White and Vermillion Cliffs, which extend southward decreasing in elevation from the Paunsaugunt Plateau near Bryce Canyon (greater than 9,000 feet) to the Shinarump Flats (less than 5,000 feet).

The Kaiparowits Plateau covers approximately 1,650 square miles in the central part of the monument (figure 2). The feature is a broad structural basin, however, the topographic expression is that of a northward-tilted plateau (Doelling and Davis, 1989). The Kaiparowits Plateau merges to the north with the Aquarius Plateau, and to the northwest with the Paunsaugunt Plateau. Elsewhere, the edge of the Kaiparowits Plateau is defined by the outcrop of Cretaceous strata (Hettinger and others, 1996). The plateau is a dissected mesa that rises as much as 6,500 feet above the surrounding terrain. The landscape is defined by four sets of cliffs and benches that form a step-like topography between the Aquarius Plateau and Lake Powell (Sargent and Hansen, 1980). The Straight Cliffs form a prominent escarpment that extends northwest to southeast along the plateau's eastern flank; the escarpment is as high as 1,100 feet along Fiftymile Mountain (figure 2).

The monument, comprised mostly of BLM- and SITLA-administered lands, is bordered by several other federally administered land units. The Dixie National Forest lies to the north of the monument. The southern boundary abuts the Glen Canyon National Recreation area. Bryce Canyon National Park is located adjacent to the west of the monument and Capitol Reef National Park is adjacent to the east of the monument. About 275 square miles of School Trust Lands are scattered throughout the monument as in-holdings (figure 3).

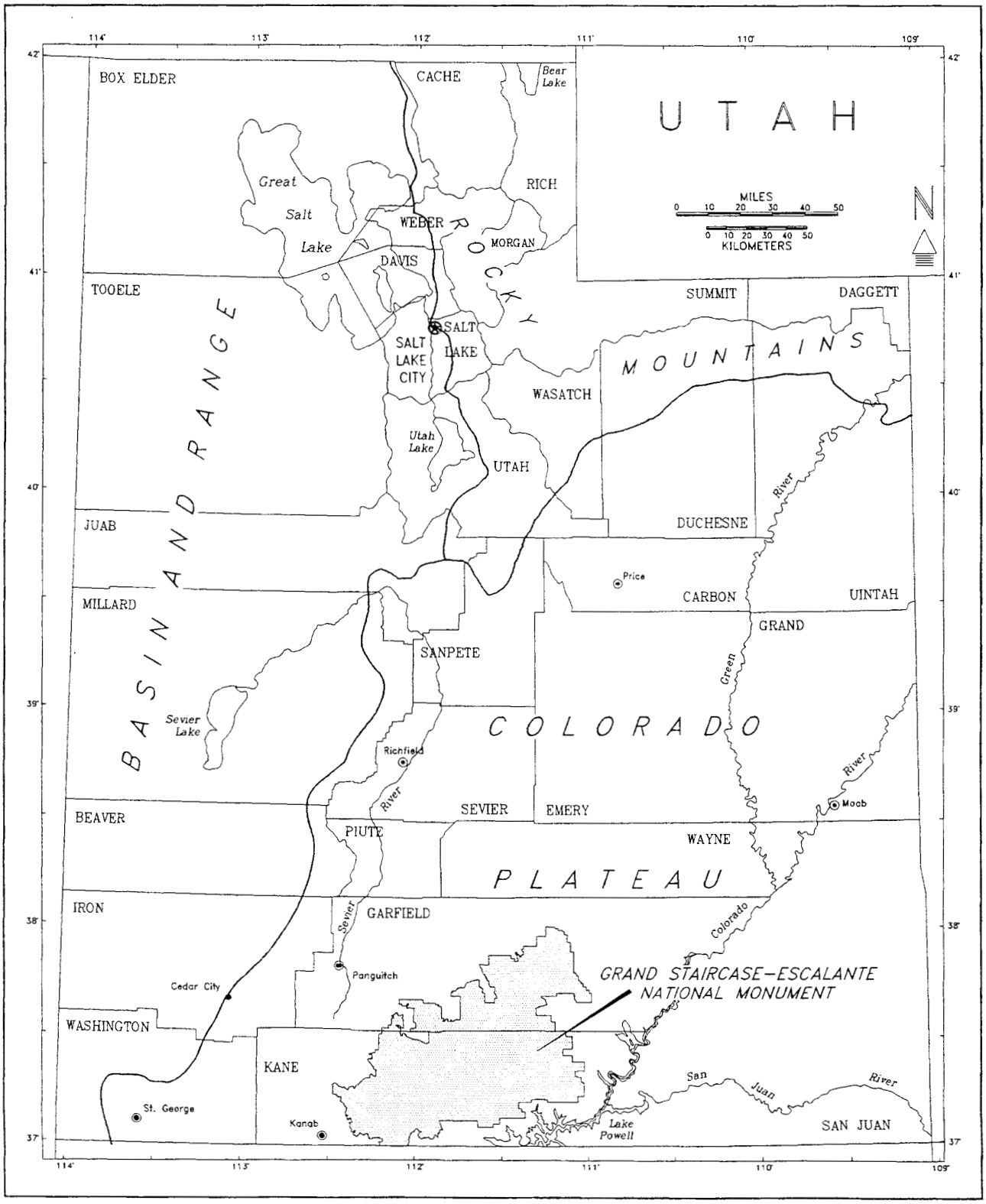


Figure 1. Location of the Grand Staircase – Escalante National Monument and physiographic provinces of Utah.

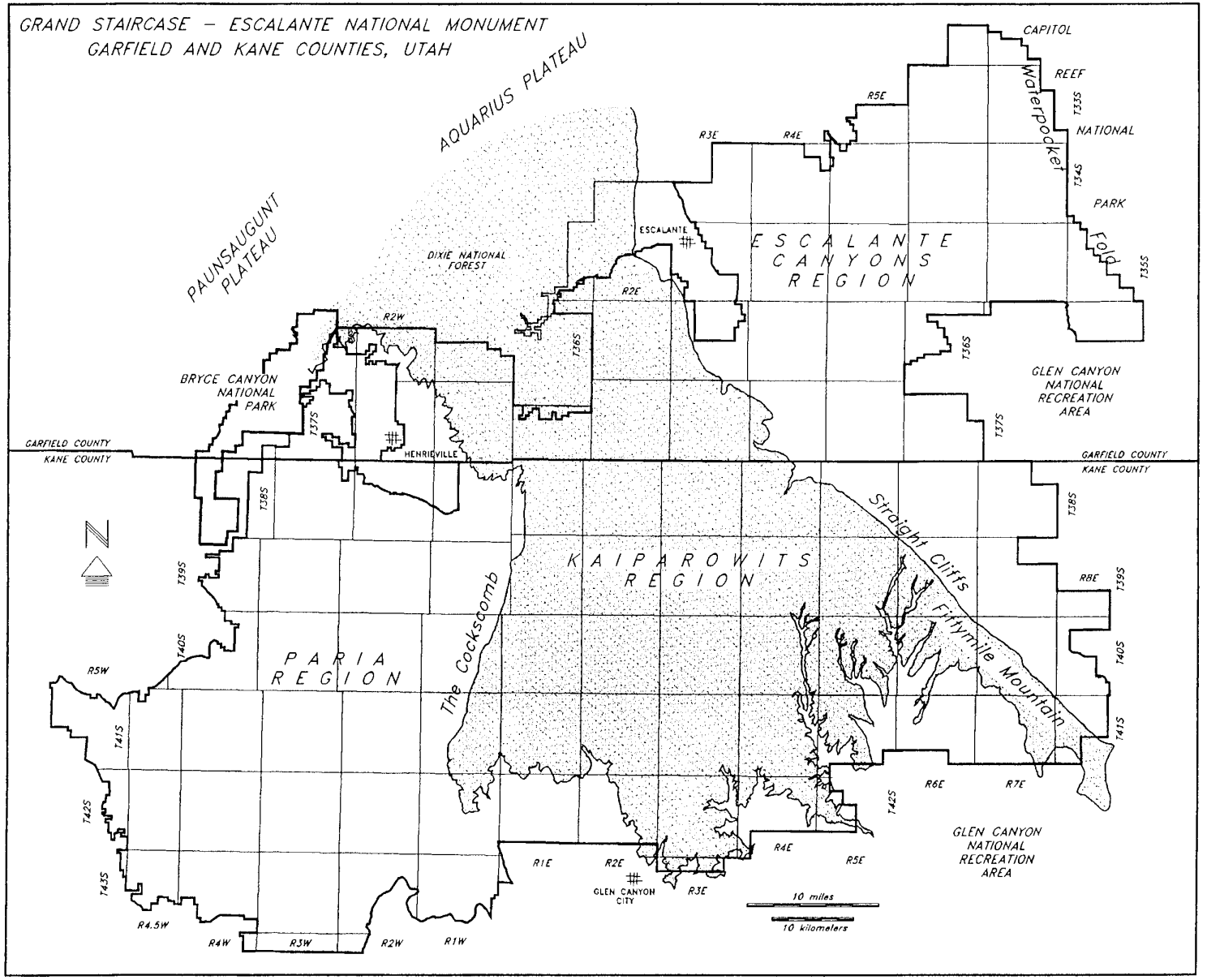


Figure 2. Physiographic features within the Grand Staircase – Escalante National Monument.

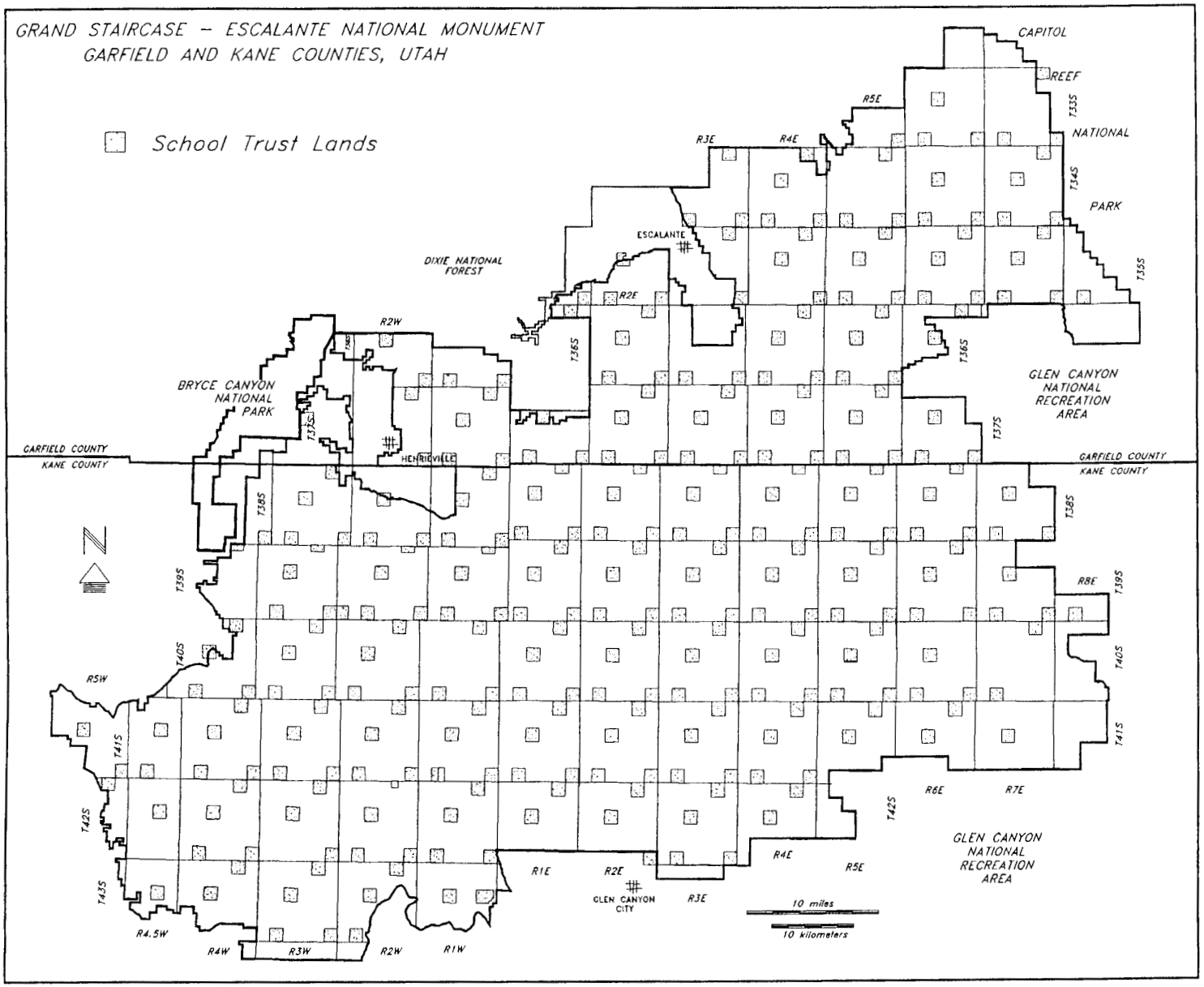


Figure 3. Location of School and Institutional Trust Lands within the Grand Staircase – Escalante National Monument.

GEOLOGY

Regional Structure

The Colorado Plateau is characterized by relatively flat-lying strata that have been locally offset and folded during vertical movements along north-south-oriented blocks in the earth's crust. These crustal movements, called tectonism, compressed and folded the overlying strata into many asymmetrical, or monoclinal, folds that have one gently dipping side and one steeply dipping side. This early compressional tectonism is referred to as the Laramide event. Later extensional tectonism caused the overlying strata along the west side of the monument to break along faults. Two structural features related to these tectonic events roughly define the eastern and western boundaries of the monument. Strata west of the north-south-trending Paunsaugunt normal fault (figures 2 and 4), near the western boundary of the monument, have dropped 2,000 feet (Doelling and Graham, 1972). The Circle Cliffs anticline, which has a steeply dipping eastern limb called the Waterpocket Fold and a gently dipping western limb, occurs at the eastern side of the monument (figure 4).

The generally northward-dipping strata of the monument area are structurally divided into two subareas by another major fold, the East Kaibab monocline (figure 2 and 4), which forms the prominent landform known as the Cockscomb. This structure, like the Circle Cliffs anticline, has a steeply dipping eastern limb and a gently dipping western limb. In addition to these three major structures, numerous smaller, but similar, folds are found in the monument area (figure 4). Beds throughout most of the monument are typically inclined less than 6 degrees; however, near the fold axes steeper dips can be found. For example, beds dip as many as 25 degrees along the western flank of the Escalante anticline, 30 degrees on the eastern limb of the John's Valley anticline, 45 degrees along the western limb of the Upper Valley anticline (Dutton monocline), and 80 degrees along the East Kaibab monocline (Hettinger, and others, 1996).

Strata within the Kaiparowits region, between The Cockscomb and the Straight Cliffs (figures 2 and 4), are inclined along numerous northerly trending folds that plunge into a deep central basin between the Kaibab uplift and the Rees Canyon anticline. Because of the overall basin structure, Cretaceous and younger rocks in the Kaiparowits region have been somewhat preserved from erosion more so than the surrounding regions. These rocks now comprise the Kaiparowits Plateau. Hettinger and others (1996) illustrated deformation of Cretaceous strata on a structure contour map of the Calico sequence boundary. The sequence boundary, which is nearly equivalent to the base of the Smoky Hollow Member of the Straight Cliffs Formation (described later), is 4,500-9,000 feet above sea level on outcrops surrounding the Kaiparowits Plateau (figure 2) and 2,000 feet above sea level in the subsurface of the Table Cliffs syncline (figure 4).

Permian through Jurassic Stratigraphy

The oldest exposed rocks in the region are Permian and crop out only along Kaibab Gulch southwest of The Cockscomb (figure 2). Exposed Permian units, from oldest to youngest, include the Hermit Shale, Coconino Sandstone, Toroweap Formation, White Rim Sandstone, and Kaibab Limestone (figure 5).

Triassic rocks are exposed in southern Kane County and include six members of the Moenkopi Formation and two members of the Chinle Formation. The Moenkopi comprises the Timpoweap, Lower Red, Virgin Limestone, Middle Red, Shnabkaib, and Upper Red Members, all deposited in intertidal or shallow marine environments. The Shinarump Member of the Chinle Formation is a fluvial conglomeratic sandstone unit resting unconformably upon the Moenkopi Formation. The upper units of the Chinle are dominated by colorful mudstones and sandstones related to fluvial channel and overbank deposition.

Peterson (1988) places Jurassic sedimentary units into divisions bounded by unconformities or depositional surfaces where little intertonguing occurs. The Glen Canyon Group, consisting of the Wingate Sandstone, Moenave and Kayenta Formations, and the Navajo Sandstone, is the oldest of the Jurassic divisions. The Wingate and Navajo Sandstones are massive, wind-deposited (eolian) units separated by the Moenave and Kayenta Formations, which are water-lain (fluvial and lacustrine) in origin. The Glen Canyon Group sediments were apparently shed from a source region to the south and east and, therefore, become thicker to the west and northwest.

The Middle Jurassic San Rafael Group consists of the Page Sandstone, the Carmel Formation, the Entrada Sandstone, and the Romana Sandstone. The lower division (Page Sandstone and Carmel Formation) is primarily marine limestone and mudstone deposits, in the western part of the region. These deposits change laterally to the east and southeast to coastal sabkha deposits of mudstone and lenticular beds of gypsum. The Entrada Sandstone comprises the middle division and is separated into three members

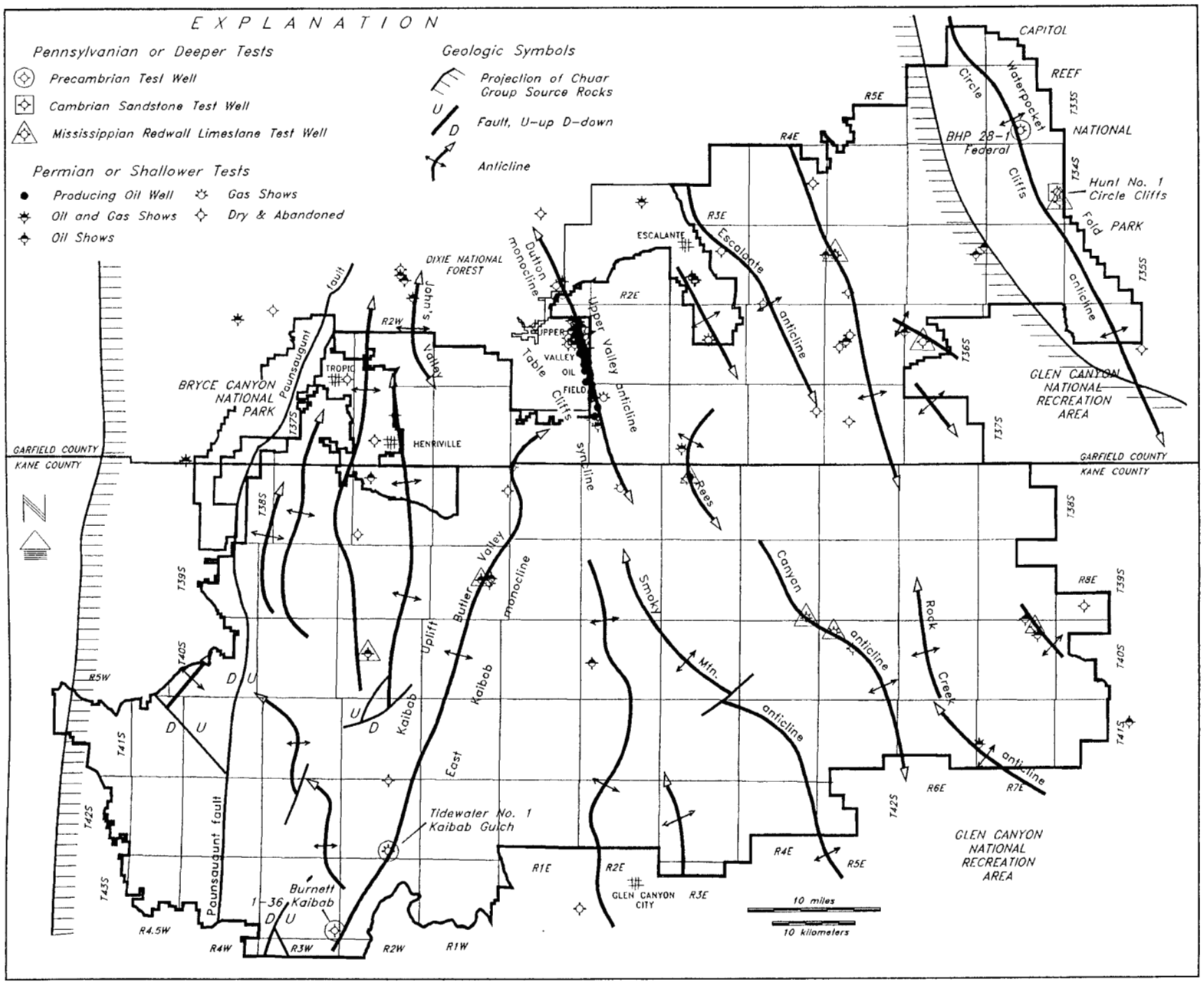


Figure 4. Principal geologic folds and locations of oil and gas wells in the Grand Staircase – Escalante National Monument (after Montgomery, 1984).

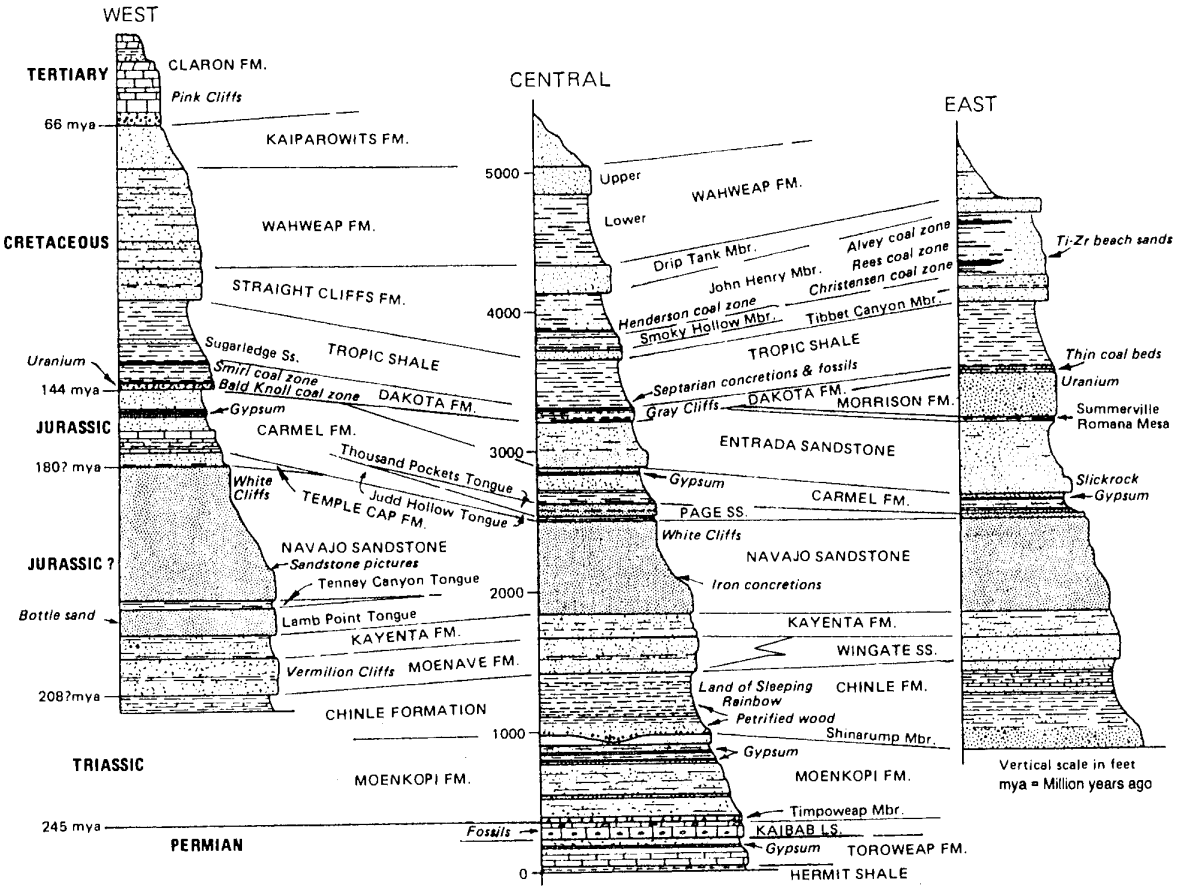


Figure 5. *Stratigraphic relationships (west to east) of exposed rock units in the Grand Staircase - Escalante National Monument (from Doelling and Davis, 1989).*

deposited in sabkha and eolian environments. The upper division consists of the Romana Sandstone which was deposited in marginal marine and eolian environments.

The Salt Wash and Tidwell Members of the Morrison Formation together form the lower division of the Upper Jurassic series. The Salt Wash Member consists of fluvial sandstone and conglomerate and very minor mudstone of lacustrine and flood-plain origin. The Tidwell Member represents dominantly lacustrine deposition with associated deposition on mudflats, in evaporative environments, and in small eolian dune fields.

The upper division of the Morrison Formation consists of the Brushy Basin Member in the northern Kaiparowits region, and the Fiftymile Member (a facies of the Brushy Basin) in the southern Kaiparowits. These units were deposited in a broad lowland containing mudflats, lakes, dune fields, and few streams. The Fiftymile Member represents an alluvial complex that gradually moved from southwest to northeast across the Kaiparowits region toward mudflat and lacustrine environments represented by the Brushy Basin Member.

Cretaceous and Tertiary Stratigraphy

As many as 7,500 feet of Upper Cretaceous strata and 3,000 feet of Tertiary strata underlie the Kaiparowits Plateau (Lidke and Sargent, 1983). Upper Cretaceous strata include, in ascending order, the Dakota, Tropic Shale, Straight Cliffs, Wahweap, and Kaiparowits Formations, and the lower part of the Canaan Peak Formation. The Dakota Formation, Tropic Shale, and Straight Cliffs Formation are exposed along the margins of the Kaiparowits Plateau but are buried by younger strata in the central region. Tertiary strata include the upper part of the Canaan Peak Formation, the Pine Hollow and Wasatch Formations, and the overlying volcanic rocks of the Mount Dutton Formation and Osiris Tuff.

Hettinger and others (1996) present the detailed stratigraphy of the Straight Cliffs Formation. The major coal beds of the Kaiparowits coal field are contained within the John Henry Member of the Straight Cliffs Formation (Late Cretaceous), that Shanley and McCabe (1991) term the Calico- and A-sequences. Peterson (1969b) formally divided the Straight Cliffs Formation, in ascending order, into the Tibbet Canyon, Smoky Hollow, John Henry, and Drip Tank Members (figure 6). The Calico and A-sequences contain all of the coal within the John Henry Member and the upper part of the Smoky Hollow Member. Peterson (1969a, b) interpreted the Tibbet Canyon and Smoky Hollow Members as a regressive stratigraphic succession consisting of shallow marine and beach deposits in the Tibbet Canyon Member and coal-bearing coastal plain strata and alluvial deposits in the Smoky Hollow Member. The John Henry Member is early Coniacian to late Santonian in age (Eaton, 1991) and consists of coal-bearing continental beds that grade eastward into a vertical stack of nearshore marine strata (Peterson, 1969a, b). These shoreface sandstone bodies are the dominant lithology along the Straight Cliffs escarpment. Continental strata within the John Henry Member contain coal in the Lower, Christensen, Rees, and Alvey coal zones (figure 6) as defined by Peterson (1969a, b). The Drip Tank Member is constrained to a late Santonian or early Campanian age (Eaton, 1991) and consists of fluvial sandstone (Peterson, 1969a, b).

THE KAIPAROWITS PLATEAU COAL FIELD

History of Mining and Exploration

Coal in the Kaiparowits Plateau region was first mined by settlers in the late 1800s near the town of Escalante, and small mines produced coal for local needs until the early 1960s. Coal investigations were first reported in the Kaiparowits Plateau by Gregory and Moore (1931), but it was not until the early 1960's that energy companies expressed interest to commercially develop coal in the region. As many as 23 companies acquired coal leases, and drilled about 1,000 coal test holes (Doelling and Graham, 1972). Plans made in 1965 to develop a 5,000-megawatt coal-burning power plant were revised in the mid 1970's to a construct only 3,000-megawatt generating plant after controversy over environmental issues. Construction plans were finally discontinued because of government action and pending lawsuits over environmental concerns (Sargent, 1984). In the latter part of the 1980s, Andalex Resources began formulating plans to mine underground and ship up to 2.5 million tons of coal annually from their leasehold in the southern part of the Kaiparowits coal field. Environmental analyses for the proposed mine, required as part of the permitting process, were underway at the time of the proclaiming of the monument.

The U.S. Geological Survey (USGS) recently performed an assessment of coal resources in the Kaiparowits Plateau coal field as part of a national coal availability assessment (Hettinger and others, 1996). The USGS study builds on the classic study of the

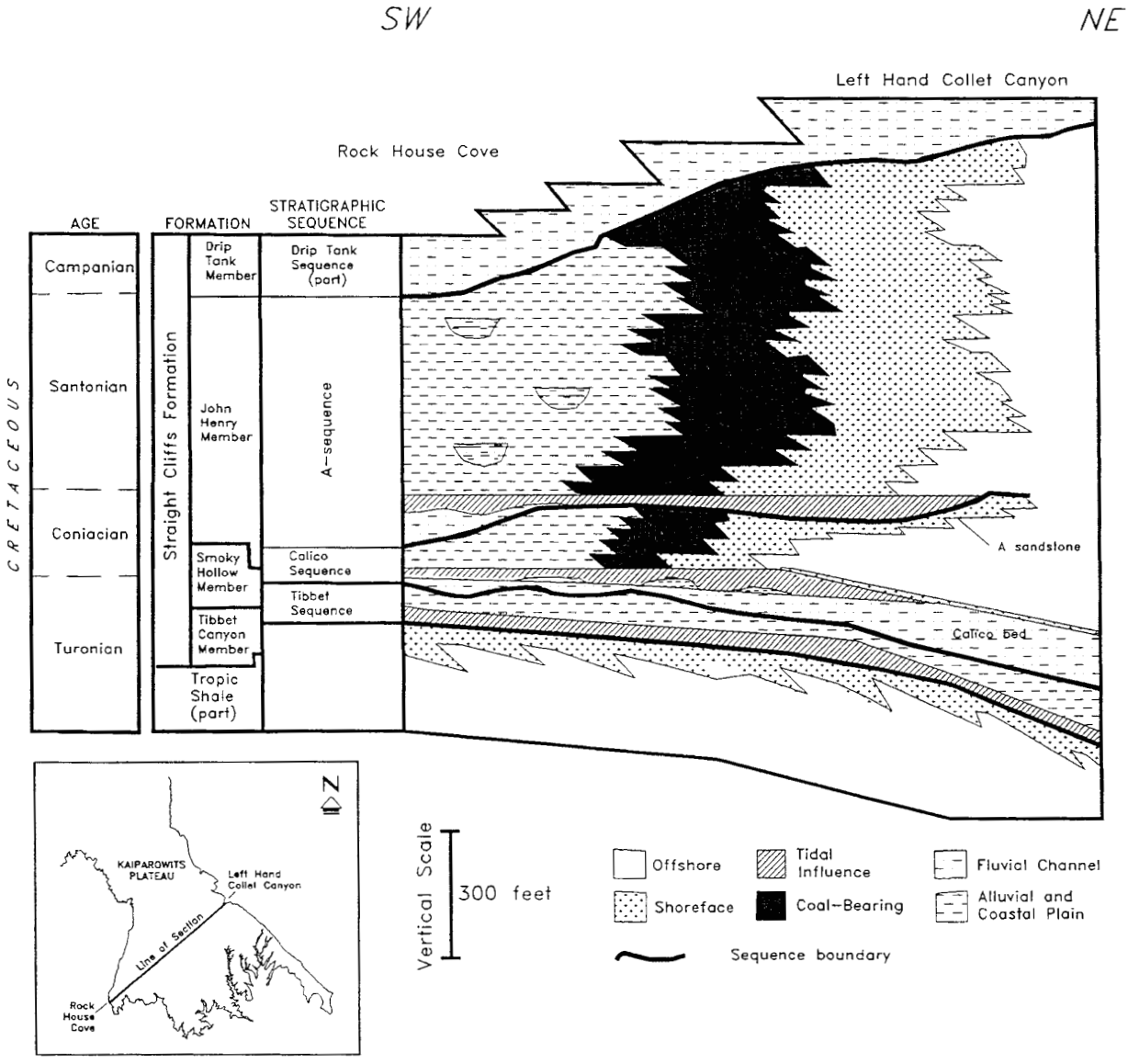


Figure 6. Stratigraphic relationships in the Straight Cliffs Formation and the upper part of the Tropic Shale, Kaiparowits Plateau (modified from Hettinger and others, 1996).

Kaiparowits Plateau coal field by the UGS (Doelling and Graham, 1972) and is based on data from geologic mapping, outcrop measurements of stratigraphic sections, and drilling that has been conducted in the region since the late 1960s. Although the distribution of coal was well documented on outcrop (Doelling and Graham, 1972), coal distribution in the subsurface remained largely unknown due to the proprietary status of company data. Recently released company drill-hole data and drilling by the USGS provided new insight into the subsurface aspects of these coals. Using a Geographic Information System, the USGS integrated these new data with existing published geologic data to construct coal correlation charts and maps that illustrate coal distribution in the Kaiparowits Plateau, and to calculate coal resources (Hettinger and others, 1996).

Coal Resources

Hettinger and others (1996) estimate that some 62.3 billion tons of original coal resources are contained in the Kaiparowits coal field (table 1). They define original resource as including all coal beds greater than one foot thick. None of the resource is minable by surface methods. Moreover, the total original resource estimate does not reflect geologic, technological, land-use, and environmental restrictions that may affect the availability and the recoverability of the coal. At least 32 billion tons of coal are unlikely minable under current conditions because the coal beds are either too deep (greater than 3,000 feet), too thin (less than 3.5 feet thick), inclined at more than 12°, or in beds that are too thick (greater than 14 feet thick) to be completely recovered in underground mining using existing mining machinery. The estimated balance of 30 billion tons of minable coal resources does not reflect land-use or environmental restrictions, does not account for coal that would be bypassed due to mining of adjacent coal beds, does not consider the amount of coal that must remain in the ground for roof support, and does not take into consideration the continuity of beds for mining. Although all of these factors will reduce the amount of coal that could be recovered, insufficient data are available to estimate recoverable coal resources. Using Hettinger and others' (1996) summary, the UGS feels that an additional 7.5 billion tons within seams 3.5 to 6 feet thick are not minable because they are too thin for current longwall operations in Utah. This leaves 22.74 billion tons minable throughout the field. Applying a conservative recovery factor of 50 percent to the minable resource leaves about 11.37 billion tons as recoverable. Other underground coal mines in Utah recover 60 to 80 percent of the minable resource. Studies of coal resources in the southeastern Appalachians have shown that less than 10 percent of the original coal resource, in the areas studied, could be mined economically at today's prices (Rohrbacher and others, 1994). Given that much of the Appalachian coal was in thin beds and was mined with much lower efficiency methods than are currently available, the 10 percent recovery should be considered an unrealistically low minimum recovery factor in the Kaiparowits coal field. Moreover, if longwall technology is redesigned allowing coal seams to be mined that are thicker than 14 feet and mining occurs deeper than 3,000 feet, then minable resources could be greater, perhaps 50 percent higher.

The Utah Office of Energy and Resource Planning (OERP) performed a preliminary analysis of the potential value of coal in the Kaiparowits Plateau coal field (Appendix B). Total coal value of 11.36 to 16 billion tons of coal, at todays price, is $221 - 312 billion. Their analysis showed that if the Kaiparowits resource were mined, the royalties on this coal to the State of Utah may approach $9.25 billion. Bonus bids and royalties on federal lands are shared equally with the state. The royalties on coal on Utah School and Institutional Trust Lands may approach $1.54 billion.

Coal Resources on School and Institutional Trust Lands

The Utah School and Institutional Trust Lands Administration (SITLA) asked the UGS to report on coal resources on Trust Lands in the Kane County portion of the Kaiparowits coal field. Following President Clinton's designation of the monument, which included all of the Kaiparowits coal field outside of national forest lands, SITLA requested that the UGS augment the previous study by also estimating coal resources on Trust Lands in the Kaiparowits coal field of Garfield County. The Trust Lands of concern generally comprise sections 2, 16, 32, and 36 in Townships 34 to 42 South, Ranges 2 West to 5 East. Data for the study were taken mostly from Blackett (1995) who summarized published measured sections from outcrops, and presented drill-hole data from confidential files. Some data points were taken from Hettinger and others (1996). The results of these two efforts, which were summarized in two unpublished UGS Technical Reports, are presented in this section and in Appendix C.

In addition to the data contained in Blackett (1995), which includes coal intercepts from more than 170 drill holes and several hundred measured sections,

Table 1. Coal resources in the Kaiparowits Plateau coal field (billions of short tons) compiled by the Utah Geological Survey from Hettinger and others (1996).

RESOURCE CATEGORY	FEDERAL	PRIVATE	STATE	TOTAL
Resources in-place	57.2	0.3	4.8	62.3
Estimated minable	20.88	0.11	1.75	22.74
Estimated recoverable	10.44	0.05	0.87	11.36

data from 32 additional exploratory holes, drilled on Trust Lands, and published measured sections were also compiled for the two Technical Reports. Geophysical logs from the drill-hole files were interpreted for coal intercepts and the intercepts were entered into the original database. Total coal penetrated by the drill holes was used as a basis for preparing maps showing contours of total coal within the Straight Cliffs Formation. In the Garfield County part of the coal field, five data points (three drill holes and two measured sections) from the USGS study (Hettinger and others, 1996) were included as well as three drill holes from other sources. The database used to generate the isopach contours included 217 drill holes and 28 outcrop measurements. Total coal was mapped using gridding and contouring computer software that manages irregularly spaced data. Several iterations of total coal contour maps were made using the inverse distance weighting method. The few erroneous data points found during the contouring were discarded from the data set, the data were re-gridded, and the contours were re-plotted.

Figure 7 shows contoured total coal thickness in the Straight Cliffs Formation to the erosional limits on the east, west, and south sides of the Kaiparowits field. Thickness contours depict the main coal resource trending northwest to southeast, in an 18-mile-wide belt parallel to the Cretaceous paleo-shoreline (documented for example by Peterson, 1988; and in Nations and Eaton, 1991). Much natural burning of coal seams has taken place mainly in the southeastern part of the Kaiparowits field where the coal beds are exposed along narrow ridges. Appendix C lists a section by section summary of coal resources based on thickness contours shown on figure 7. Listed are locations of the Trust Land sections, estimated acreage, estimated coal thickness, and total tons of coal in place. The last column notes those sections where resources are demonstrated by drilling, where the resource might be naturally burned, or where the presence of the resource is questionable due to erosion.

The UGS calculated that roughly 4.45 billion tons of coal resources lie in-place on SITLA lands within the Kaiparowits coal field of Garfield and Kane Counties. Of this total, the UGS estimated that 2.38 billion tons may be considered demonstrated reserves in relatively close proximity to drill holes. This estimate includes all coal seams of one-foot thickness or greater. Hettinger and others (1996) estimated that 4.8 billion tons of coal resource are contained on SITLA lands in the Kaiparowits Plateau field. Using the same criteria and recovery factor as previously stated, the UGS estimates that 876 million tons to 1.3 billion tons of coal are recoverable from Trust Lands.

Sulfur Content of Kaiparowits Coal

Sulfur content of the coal in the Kaiparowits coal field is variable, but generally low, averaging less than 1.0 percent. Coal beds in the Smoky Hollow area, near the proposed Andalex mine, are particularly low in sulfur, averaging 0.45 percent. Data taken from the UGS coal quality database and information from Andalex Resources, are summarized below:

Area/seam	No. Samples	Avg. Sulfur %
Alvey zone	25	0.86
Christensen zone	31	1.02
Henderson zone	15	0.87
Rees zone	11	0.79
Warm Springs mine	42	0.45

This range of in-ground sulfur contents appears similar to the range of sulfur contents found in the Book Cliffs and Wasatch Plateau coal fields of Utah which typically produce coal ranging from 0.44 to 0.71 percent. Such low-sulfur coals have been in high demand in recent years, particularly since 1994 with the implementation of the sulfur emissions portion of the Federal Clean Air Act of 1990. While overall U.S. coal usage has increased at 2 to 3 percent in recent years, demand for Utah's low-sulfur coal has grown annually at a rate of about 10 percent since 1994. This reflects the switching by electric utilities from higher sulfur content eastern U.S. coal to lower sulfur western U.S. coal. New and growing market demand for low-sulfur coal has prompted Andalex Resources to pursue mining of

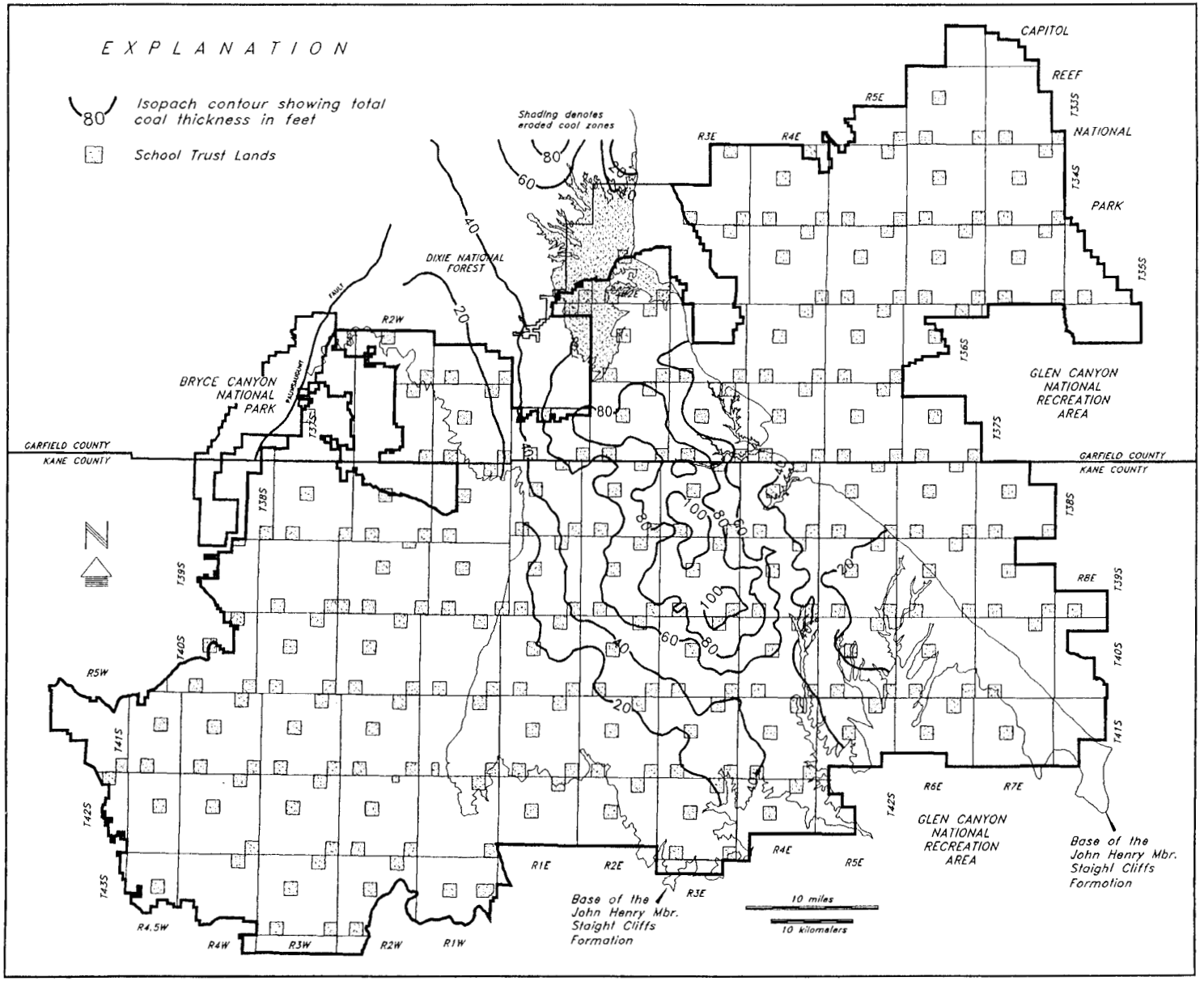


Figure 7. Grand Staircase – Escalante National Monument showing generalized contours of total coal thickness in the Kaiparowits coal field, and the location of School and Institutional Trust Lands.

the low-sulfur Kaiparowits coal. Washing of the coal, as is done with some of the Book Cliffs and Wasatch Plateau coals, would further reduce the sulfur content of the Kaiparowits coals.

Coal-bed Gas Resources

The major coal deposits and associated coal-bed gas within the monument occur in the John Henry Member of the Straight Cliffs Formation. As mapped by Hettinger and others (1996), the net coal thickness in the John Henry Member ranges from zero along the eastern and western edges of the Kaiparowits Plateau to as much as 150 feet thick in the center of the plateau. Within the monument, coal beds are found at the surface around the margins of the Kaiparowits Plateau and extend into the subsurface to depths of nearly 6,000 feet. Based on general industry guidelines, areas considered prospective for coal-bed gas have at least 10 feet of coal (net thickness) which is found at depths between 1,000 and 6,000 feet. The area prospective for coal-bed gas within the monument is primarily covered by seven 7.5 minute quadrangles; Butler Valley, Canaan Peak, Death Ridge, Fourmile Bench, Horse Mountain, Petes Cove, and Ship Mountain Point (figure 8). The deep coal resources for these seven quadrangles, as determined by Hettinger and others (1996), is summarized in table 2 along with an estimated range of potential gas resources. The gas contents for the deeper coal resources in the monument were estimated to range from 100 to 400 cubic feet per ton, based on the range of gas contents seen elsewhere in deep Utah coals. Actual desorption tests by the UGS of five shallow John Henry Member coals, from depths of less than 800 feet, only contained as much as seven cubic feet of gas per ton of coal (Sommer and others, 1993). However, other productive fields in the state also show low gas contents in shallow coal beds. The deeper John Henry Member coals of the monument are estimated to contain in-place coal-bed gas resources ranging from 2.6 to 10.5 trillion cubic feet, assuming gas contents ranging from 100 to 400 cubic feet per ton. Considering a recovery factor of 67 percent, and current market prices of $1.20 to $2.50 per thousand cubic feet, the coal-bed gas could be worth from $2 billion to $17.5 billion.

Further Coal Resource Assessments Needed

The coal-bed gas resources presented for the monument in this report are simply estimates. There are adequate data available to identify the presence and location of thick, deep coal deposits, however there are no good measurements of the gas content contained in the deep John Henry Member coals of the Kaiparowits Plateau coal field. To prove the presence, or absence, of coal-bed gas requires that some deep core samples be taken for desorption and isotherm studies. Further, the presence of significant gas volumes in coal beds does not always translate to an economically producible field. There are approximately 37 School Trust sections of land regularly spaced within the monument area prospective for coal-bed gas. Test wells drilled and cored on perhaps a dozen or more of these sections would probably provide an adequate data set to test for the presence of significant gas volumes in the coal beds. If significant gas was found in the deep John Henry Member coals, several five-spot patterns of test wells may need to be drilled on two or three widely-spaced sections to test the productive capacity of the coals, and see if they can be successfully dewatered.

OIL AND GAS POTENTIAL

The monument contains all the elements necessary for major oil and gas accumulations: source rocks, reservoirs, and trapping mechanisms. Commercial deposits of oil have been discovered both within and along the margins of the monument at Upper Valley field (figure 4). Although the characteristics of the monument and Kaiparowits basin as a whole are favorable for the accumulation of oil and gas, wildcat density is extremely sparse. Only 47 exploratory wells have been drilled within the monument or an average of 57 square miles per well. The postulated reasons for this apparent lack of exploratory activity are: (1) remoteness, (2) lack of oil and gas pipelines, (3) low success rates, (4) the collapse of world oil prices in 1986 and a nationwide oversupply of natural gas, and (5) environmental concerns.

However, during the 1990s the Kaiparowits basin and surrounding areas (including the monument) have gained the attention of the petroleum industry as two play concepts developed: (1) Precambrian-source oil and (2) hydrodynamically displaced oil (where the fluid-potential gradient is such that the flow of water is directed down dip barring the up-dip movement of oil). As a result, 141,068 acres of federal land and 49,104 acres of School Trust Lands within the monument are under lease for oil and gas exploration. Seismic data acquisition and drilling activity have increased; several additional wells are in the planning stage either within or near the borders of the monument.

Industry representatives reported attempts to lease an additional 60,000 acres of BLM lands by oil

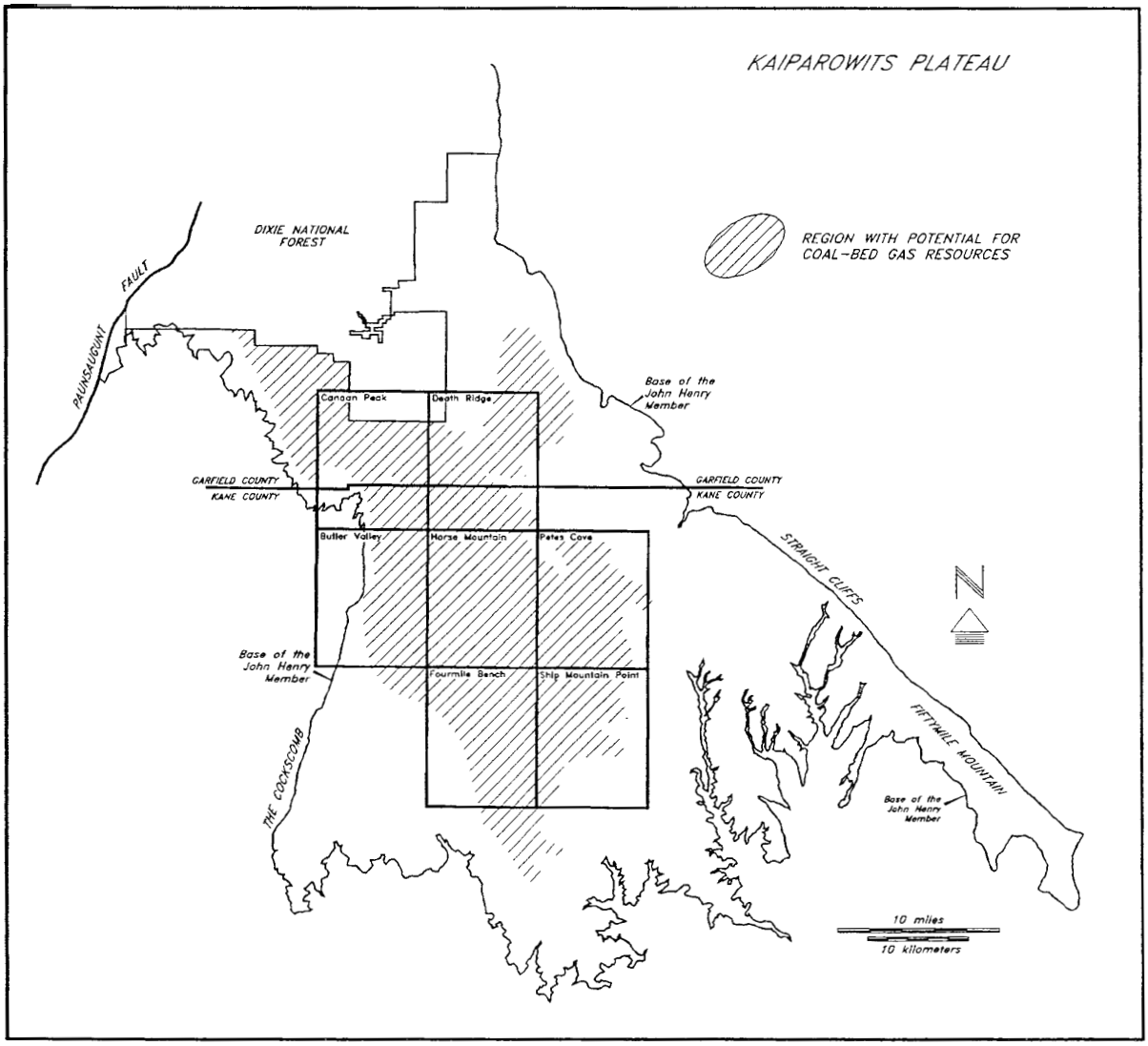


Figure 8. Region favorable for coal-bed gas in the Kaiparowits coal field. Hatchured pattern depicts region where the net coal thickness is greater than 10 feet and coal beds are covered by 1,000 to 6,000 feet of overburden.

Table 2. Coal-bed Gas Resources of the Grand Staircase-Escalante National Monument.

QUADRANGLE	IN-PLACE COAL RESOURCES (millions of tons)				IN-PLACE GAS RESOURCES	
	Depth Range (ft)				(in millions of cubic feet)	
	1,000-2,000	2,000-3,000	3,000-6,000	TOTAL	100 cu ft/ton	400 cu ft/ton
Bulter Valley	89.1	1,002.4	19.4	1,110.9	111,090	444,360
Canaan Peak	189.0	1,204.9	1,581.3	2,975.2	297,520	1,190,080
Death Ridge	4,088.4	1,534.0	0.1	5,622.5	562,250	2,249,000
Fourmile Bench	427.9	2,129.3	0.0	2,557.2	255,720	1,022,880
Horse Mountain	840.4	4,371.8	676.6	5,888.8	588,880	2,355,520
Petes Cove	4,479.6	891.2	0.0	5,370.8	537,080	2,148,320
Ship Mtn Point	1,678.4	1,064.2	0.0	2,742.6	274,260	1,097,040
TOTAL	11,792.8	12,197.8	2,277.4	26,268.0	2,626,800	10,507,200

companies in 1996, were denied by the BLM. BLM officials state that those lands falling within H.R. 1500 (Utah BLM Wilderness Act of 1989) were held pending resolution of the Act. Lease applications within the monument but outside of H.R. 1500 were issued. Following creation of the monument, all applications pending were rejected.

Analogous accumulations of oil and gas in terms of source, reservoirs, and trapping mechanisms are found elsewhere in the U.S. and other oil-producing countries. Although the risk of failure is high, the monument could contain major accumulations of oil based on the production history of Upper Valley field and geologic evidence presented in this section.

Source Rocks

Known source rocks in the Precambrian, Mississippian, and Permian are present south, west, and north of the monument. Carrier formations and major faults can provide migration pathways through which oil and gas generated from these source rocks could have migrated into reservoirs and traps in the monument. In addition, potential source rocks within the monument may also provide local hydrocarbon-generating capabilities.

Precambrian Chuar Group

The Proterozoic (Precambrian) Chuar Group of the Grand Canyon Supergroup exposed in the Grand Canyon represents the greatest untested source of hydrocarbons in the monument (figure 9). These outcrops have been evaluated by Reynolds and others (1988), Palacas and Reynolds (1989) Cook (1991); and Lillis and others (1995). The Chuar Group consists of 14,000 feet of unmetamorphosed rocks deposited in a basin 950 to 800 million years ago (Ma). Organic material flourished in depositional environments which included nearshore marine, lacustrine, paludal, and coastal plain (Reynolds and Elston, 1986; Reynolds and others, 1988).

During the creation of the Late Proterozoic western margin of North America, the Chuar deposits were broken into blocks by high-angle, down-to-the west, extensional normal faults (Huntoon, 1971). The duration of the event represented by the "Great Unconformity" between the Cambrian Tapeats Sandstone and underlying Precambrian in the Grand Canyon was about 250 million years. The Chuar and its potential source rocks were preserved in northeast-tilted blocks along north-south-trending rift or normal faults observed today in the eastern Grand Canyon. Figure 4 indicates the maximum extent of Chuar "fairway" in the subsurface based on limited well control and outcrops (Chidsey and others, 1990; Rauzi, 1990; and Utah Geological Survey, 1991). This fairway encompasses essentially all of the monument. However, it is important to note that the fairway is likely broken up into blocks similar to those observed in the Grand Canyon and preservation of Chuar source rocks would be limited. Only seismic data and additional drilling can define the presence of these blocks. If Chuar is present, then a local Precambrian hydrocarbon source is provided, whereas a long distance migration is required from Chuar rocks known to exist in the Grand Canyon.

Work by Reynolds and others (1988), Palacas and Reynolds (1989), and Cook (1991) indicate that the Walcott Member of the Kwagunt Formation within the Chuar Group contains over 680 feet of dark-gray to black mudstone, shale, and siltstone deposited in a shallow lacustrine environment where abundant planktonic microbiota created reducing conditions

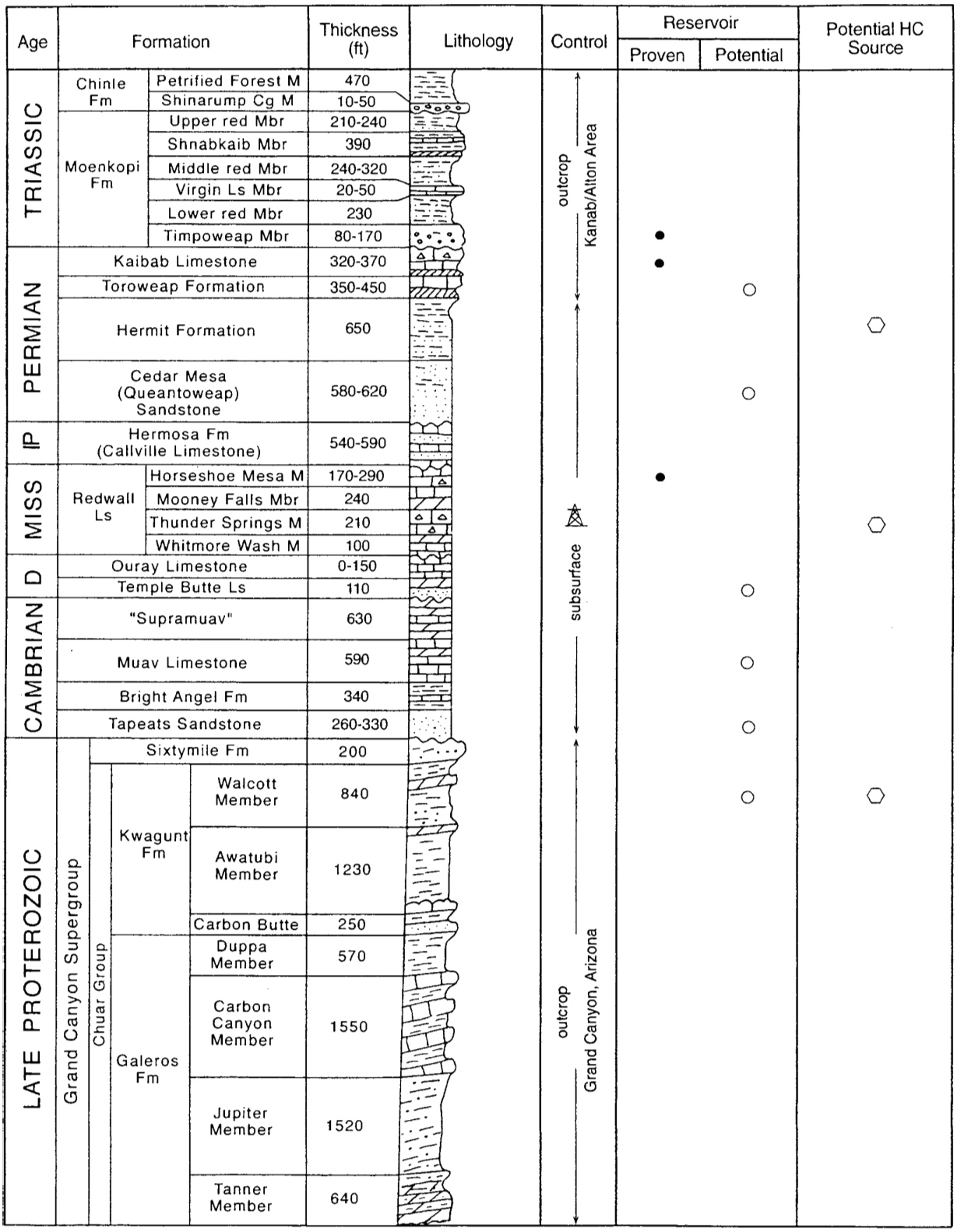


Figure 9. *Composit stratigraphic column for the Grand Staircase - Escalante National Monument, Utah indicating oil and gas reservoirs and source rocks (modified from Hintze, 1988).*

(Reynolds and Elston, 1986; Reynolds and others, 1988). These rocks are organic rich, over 4.7 percent total organic carbon (TOC), and maturity assessments (Rock-Eval pyrolysis) place them in the principal oil-generating window (table 3).

The Tidewater No. 1 Kaibab Gulch well (section 34, T. 42 S., R. 2 W., Salt Lake Base Line, Kane County), drilled in 1956, is inside the monument (figure 4). This well penetrated 900 feet of dark-gray shale assigned to the Chuar Group (figure 10). Munger and others (1965) reported an abundance of carbonaceous material and associated plant-like spores. However, the analyses of well cuttings by the UGS suggest that these rocks would be poor sources of hydrocarbons (table 3). Possible explanations for the poor source-rock characteristics of the section encountered include: (1) that the rocks belong to some other formation within the Grand Canyon Supergroup (figure 9), (2) the rocks penetrated are a part of the Chuar not containing source rocks, or (3) depositional conditions of the Chuar basin at this locale was not conducive to the development of source rocks.

Uphoff (1997) calculated source-rock volumetrics for a 150 square mile area within the monument along the north-northwest-trending axis of the Kaiparowits basin. This represents a conservative sized area and considerably larger area would be expected to contain Chuar source-rocks. Using a source-rock thickness of 160 feet, an average total organic carbon (TOC) content of 4 percent, and a hydrogen index of 200 mg HC/g TOC, the calculated total volume of hydrocarbons generated was 2,700 million barrels (Uphoff, 1997). When applying an entrapment rate of 10 percent, equal to the typical success rate for exploratory wells, potential trapped oil in-place could be 270 million barrels or more within the monument from this source alone. Using a 20 percent oil-recovery factor and a value of $20 per barrel, the value of this oil would be $1.08 billion. At the low end of oil-reserve potential, at least one million barrels of oil worth $20 million are likely to be recovered from further development of Upper Valley field and from discoveries of oil generated from source rocks other than Precambrian.

Mississippian Formations

The Mississippian Redwall Limestone is a proven producer of oil within the Kaiparowits basin (figure 9). There are three possible Mississippian sources for this production: (1) the Chainman Shale of the eastern Great Basin, (2) the Manning Canyon Shale of north-central Utah, and (3) the Thunder Springs

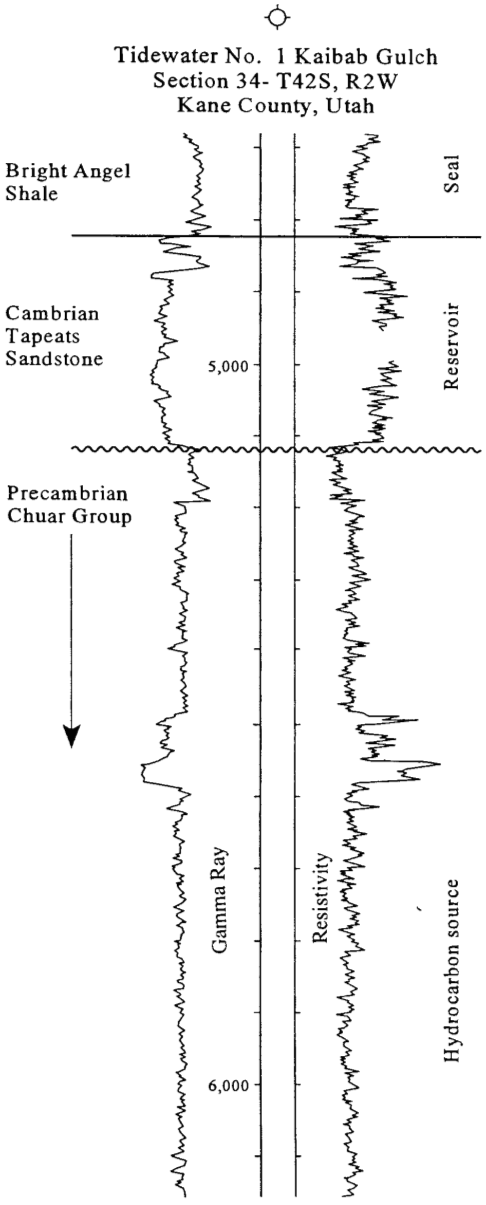


Figure 10. Geophysical well log from the Tidewater No. 1 Kaibab Gulch well, Kane County, Utah indicating potential hydrocarbon source rocks, reservoir, and seal.

Table 3. Source-rock characteristics of the Walcott Member, Kwagunt Formation of the Precambrian Chuar Group, eastern Grand Canyon, Arizona (Palacas and Reynolds, 1989) and the Tidewater No. 1 Kaibab Gulch well, Grand Staircase - Escalante National Monument, Utah.

Location	TOC (%)	S_1 (mg HC/g rock)	S_2 (mg HC/g rock)	HI (mg HC/g TOC)	OI (mg CO_2/g TOC)	PI S_1/S_1+S_2	T_{max} (°C)	CEOM (ppm)	EH (ppm)	R_o (%)
Grand Canyon	4.7	2.15	9.60	204	17	0.18	441	4,900	3,200	0.76
1 Kaibab Gulch	0.92	0.14	0.38	41	110	0.27	438	-	-	-

Explanation: TOC - total organic carbon, S_1 - volatile or free hydrocarbons, S_2 - pyrolytic hydrocarbons, HI - hydrogen index, OI - oxygen index, PI - production index, T_{max} - temperature corresponding to the maximum of hydrocarbon generation (level of thermal maturity), CEOM - chloroform extractable organic matter, EH - extractable hydrocarbons, R_o - vitrinite reflectance.

Member of the Redwall Limestone of southern Utah. The Chainman Shale generates the oil in several fields in Railroad Valley Nevada (Poole and Claypool, 1984). This formation and its equivalents extend into western Utah and could provide a long-distance hydrocarbon source through several potential carrier formations. The Manning Canyon Shale is rich in organic material though little work has been published pertaining to its source-rock potential. Oil from this formation would also require a long-distance migration to have accumulated in the monument. However, the Thunder Springs Member of the Redwall Limestone provides a possible local source. In 1990, Beard Oil Company drilled the Tanner 1-27 well (section 27, T. 28 S., R. 3 E., Salt Lake Base Line) near the town of Loa in Wayne County. Well cuttings indicated characteristics of source rocks in the Thunder Springs Member (verbal communication, Martin Pruatt, Beard Oil Company, 1990). A drill-stem test of the Redwall in this well, however, recovered only muddy and gassy water.

Permian Formations

Oil collected form the Permian Kaibab Limestone reservoir at Upper Valley field was geochemically analyzed and correlated with known genetic oil families in north-central Utah (Sprinkel and Castaño, 1997). This geochemical correlation indicates a Permian source, probably the organic-rich shale of the Phosphoria or Park City Formations in the Uinta or Oquirrh basins to the north. These formations have long been recognized as having source rocks (Maughan, 1984). Again, a long-distance migration is required to develop oil accumulations in the monument from these rocks. Oil may also be derived from an unrecognized local Permian source, possibly the Hermit Formation (figure 9).

Other Possible Source Rocks

Several other sources of oil could be derived from formations outside the monument through long-distance migration in carrier beds or along major faults. The Devonian Pilot Shale in the eastern Great Basin is recognized as a petroleum source rock although no production of Devonian oil is known in Utah (Sandberg and Poole, 1975). All fields which produce oil and gas from the Pennsylvanian Paradox Formation in the Paradox basin of southeastern Utah and southwestern Colorado were source from cyclic, black, organic-rich shales within the formation (Hite and others, 1984). Oil migrating from the basin could account for numerous live oil shows in the Permian Cedar Mesa Sandstone penetrated by several wells within the monument.

Potential Reservoirs

Potential reservoirs that may contain significant quantities of hydrocarbons in the monument are the Precambrian Chuar Group, Cambrian Tapeats Sandstone, Mississippian Redwall Limestone, Permian Kaibab Formation, and Timpoweap Member of the Triassic Moenkopi Formation (figure 9). The latter three are productive at Upper Valley field. Other potential reservoirs include the Cambrian Muav Limestone, Devonian Temple Butte Limestone, and Permian Cedar Mesa Sandstone and Toroweap Formation.

Chuar Group

The Chuar Group in the Grand Canyon crops out as a 5,370-foot-thick succession of very-fine-grained siliciclastic rocks composed of thin sequences of sandstone with stromatolitic and cyrptalgal carbonate (Reynolds and others, 1988). Cuttings from the

Tidewater No. 1 Kaibab Gulch well contain fine-grained, well-sorted quartzarenites. These sandstones consist predominately of monocrystalline quartz; feldspar is almost entirely leached from the rock. Cementing agents include silica (the dominant agent), and minor amounts of anhydrite, dolomite, and pore-lining clay. Moderate compaction has occurred.

These rocks have low porosity and permeability. Pervasive silica over-growths have greatly reduced the original intergranular porosity and the size of interconnecting pore throats. What porosity remains is mainly secondary in origin, resulting from leaching of unstable framework grains. For these units to contain oil, porosity and permeability must be enhanced by significant fracture development.

Tapeats Sandstone

Outcrops of the Cambrian Tapeats Sandstone in the Grand Canyon consist of coarse- to medium-grained feldspathic and quartzarenite (Middleton, 1989). These sandstones were deposited initially in a braided stream setting (Middleton and Elliot, 1990). Widespread progradation of the sea resulted in shallow marine to shoreface deposition of blanket sands over the underlying coastal plain (Middleton and Elliot, 1990). These sandstones are 200 to 300 feet thick in the Kaiparowits basin. The Tapeats is locally absent due to the presence of Precambrian "islands" which can be observed along the Colorado River in the Grand Canyon. This situation is also likely to be present within the monument.

Cuttings from Tapeats in the Tidewater No. 1 Kaibab Gulch well contain white, fine-grained, well-sorted quartzarenites. Framework grains consist predominantly of well-rounded, monocrystalline quartz cemented by abundant silica overgrowths and minor amounts of dolomite, pyrite, calcite, and clay. Other Tapeats zones consist of pink, dolomitic and green-gray, glauconitic sandstones. The pink, dolomitic sandstones are medium- to coarse-grained. Framework grains are well-rounded, dominantly monocrystalline quartz, cemented by silica overgrowths and pore-filling dolomite. Green-gray, glauconitic sandstones consist of moderately sorted, laminated, very-fine- to fine-grained, micaceous sandstone alternating with laminae of siltstone.

The quartzarenites are characterized by relatively well-developed primary intergranular porosity, some of which is solution enhanced. Bitumen partially fills intergranular pore space and is associated with pore-lining clay. Porosity values of apparent permeable beds range from 7 percent in the BHP Circle Cliffs No. 28-1 Federal well (section 28, T. 33 S., R. 7 E., Salt Lake Base Line, Garfield County) to as high as 13 percent in the Tidewater No. 1 Kaibab Gulch well (Uphoff, 1997). The pink, dolomitic and green-gray, glauconitic sandstones have low effective porosity and permeability in the cuttings evaluated.

Redwall Limestone

The Mississippian Redwall Limestone in the Kaiparowits basin is a widespread, 500- to 1,200-foot-thick, dense, crystalline dolomite and limestone containing varying amounts of chert (Doelling, 1975; Doelling and others, 1989). The Redwall was deposited in an open-marine environment on the cratonic shelf east of the Cordilleran geosyncline. The formation thins and becomes more dolomitic to the southeast (Montgomery, 1984).

The Redwall is equivalent to the Leadville Limestone in the Paradox basin where it is the main oil reservoir in the Lisbon field. Bordering the monument, the Redwall produced 17,000 barrels of oil from one well in Upper Valley field (Sharp, 1976). As a potential reservoir, the Redwall exhibits intergranular, vuggy, and cavernous porosity (Doelling, 1975). After deposition, the upper part of the formation was subjected to subaerial erosion and solution resulting in the development of a karst topography (Doelling, 1975; Doelling and others, 1989). Fracturing and solution brecciation are also present (Montgomery, 1984).

In an oil reservoir with a karst overprint, production come from a heterogenous combination of fractures, vugs, and caves. Horizontal drilling can be used to intersect more fractures and overcome reservoir heterogeneity. This technique greatly increases the chance of drilling success and production rates in reservoirs with karst topography. Therefore, the Redwall is a good candidate for horizontal drilling.

Kaibab Limestone

The Permian Kaibab Limestone is the major oil-producing reservoir within the monument. The Kaibab is fairly widespread throughout the monument, ranging in thickness from 100 to 370 feet (Hintze, 1988). The reservoir portion of the formation consists of skeletal, bioturbated, glauconitic, sandy, dolomite grainstone (Sharp, 1978). Chert nodules are abundant. The Kaibab was deposited in a shallow, open-marine environment.

In Upper Valley field, there are two zones affected by facies changes and diagenetic alteration (Sharp, 1976; 1978). Similar conditions should also be

present in some other areas of the monument. Fracturing due to solution brecciation and tectonic folding enhances porosity and permeability in the upper Kaibab. Porosity ranges from 16 to 18 percent and the maximum permeability is 300 millidarcies (md) with an average of 100 md (Sharp, 1978; Allin, 1993).

Timpoweap Member of the Moenkopi Formation

The Timpoweap Member of the Triassic Moenkopi Formation also produces oil within the monument. Though not as prolific a producer or as widespread as the Kaibab, the Timpoweap is a viable potential reservoir. The Timpoweap ranges in thickness from 20 to 150 feet (Doelling and others, 1989). The reservoir portion of the Timpoweap consists of oolitic and skeletal, grain-supported dolomites, algal mat dolomites, and calichefied dolomites (Sharp, 1976). These dolomites were deposited in open-shallow marine, intertidal and restricted-shallow marine, and supratidal environments.

In Upper Valley field, like the Kaibab, the Timpoweap produces oil from two zones which are also affected by rapid facies changes and diagenetic alteration (Sharp, 1976, 1978). These conditions are similar to those in the Kaibab and should exist to a greater extent than the Kaibab over much of the monument. An unconformity separates the two zones. Diagenesis and fracturing related to subaerial exposure at the unconformity are responsible for the creation and destruction of porosity and permeability in the lower reservoir (Sharp, 1976). Porosity averages 8 percent, permeability ranges from 2.5 to 141 md (Sharp, 1976).

Trapping Mechanisms

During the Laramide Orogeny (Late Cretaceous and Early Tertiary) the high-angle normal faults created during the Precambrian underwent reverse movement forming numerous surface anticlines and monoclines observed within the Kaiparowits basin and surrounding region (figure 4). These basement- or Chuar-cored structures are the potential localities for both Precambrian-source and hydrodynamically displaced oil. The monument contains at least 24 major structures, many tens of miles long (figure 4). Numerous subsidiary closures, analogous to those which produce hydrocarbons along the Moxa arch in the Green River basin of southwestern Wyoming, are likely to be present along these structures. Only three wells have penetrated through the Cambrian Tapeats Sandstone and into Precambrian rocks on major anticlines in the monument. Although these wells were dry, other closures probably on the anticlines, remain untested. The depth to the Precambrian ranges from 5,000 to 10,000 feet in the monument.

Precambrian-Source Oil

Precambrian-source oil is most likely trapped in sandstone reservoirs of the Chuar Group or in the Tapeats Sandstone (figure 11). The trapping mechanisms for Precambrian oil in the Chuar include: (1) updip sandstone pinchouts, (2) normal or reverse faults, (3) the angular unconformity, and (4) fracture zones. Identification of these types of traps would require numerous, high-quality seismic records and are considered the type of drilling targets with the highest risk of failure.

The more likely drilling target is the Tapeats Sandstone along the major anticlines and associated subsidiary closures. Oil trapped in Tapeats structures could have been sourced from the Chuar, where it is in direct contact on preserved rift blocks. The Tapeats could have also served as a carrier bed from Chuar to structural traps elsewhere. The Cambrian Bright Angel Shale directly above the Tapeats is a 250- to 450-feet-thick series of interbedded micaceous shale and sandstone (Uphoff, 1997). The Bright Angel Shale has hydraulically sealed the Tapeats from the overlying Paleozoic section (Huntoon, 1977). Modeling of the Kaiparowits basin by Uphoff (1997) determined qualitatively a range of generation-migration timing. According to this model, hydrocarbon generation from Chuar source rocks began in the Early-Middle Cretaceous (100-150 Ma) and continued until mid-Tertiary (30-40 Ma). This oil-generating window overlaps the Laramide Orogeny thereby making all the structures in the monument potential targets for Precambrian-source oil. The combination of source, migration timing, reservoir quality, structure, and seal define the virtually untested Tapeats Sandstone as a prime candidate for exploratory drilling.

Hydrodynamically Displaced Oil

Potential reservoirs, such as the Redwall Limestone, Kaibab Limestone, the Timpoweap Member of the Moenkopi Formation, and others, are present along the same Laramide structures that have Tapeats potential. However, many of the structures have been drilled through the upper and middle Paleozoic section, and all have been barren of hydrocarbons.

Unlike the sealed Tapeats Sandstone, the rest of the Paleozoic and Mesozoic rocks have been subjected to freshwater flushing. Work by Goolsby and

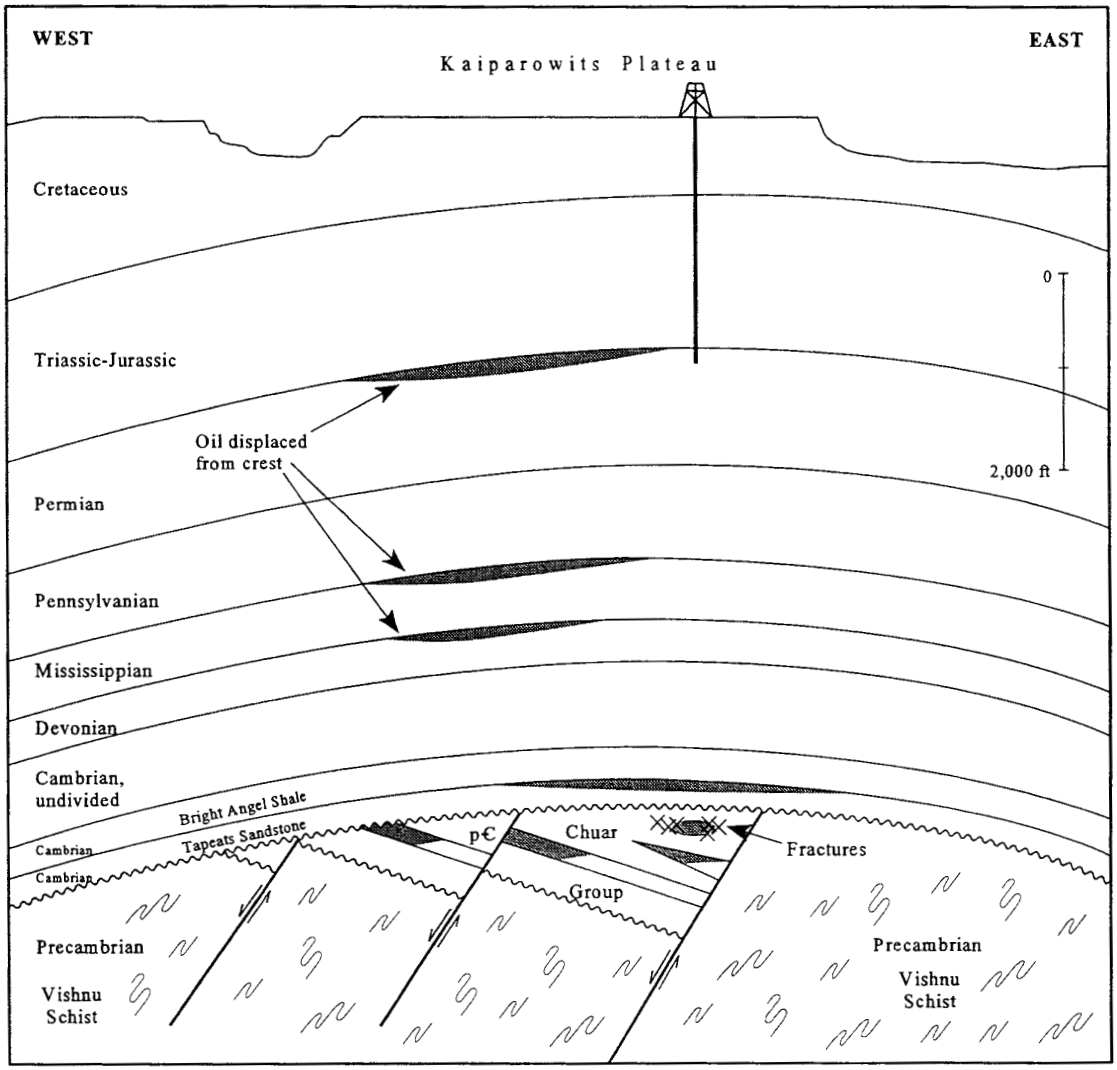


Figure 11. *Potential oil and gas traps within the Grand Staircase - Escalante National Monument.*

others (1988) and Tripp (1993) suggest hydrologic conditions have had a great impact on trapping of hydrocarbons over large areas of the western Colorado Plateau. Allin (1990) stated that most of the crests of major structures on the western Colorado Plateau once contained hydrocarbons.

During the Pleistocene, deep dissection of the Colorado Plateau changed the original hydrodynamic picture (Allin, 1990, 1993). Much of the trapped oil was probably lost to the Colorado River drainage. The hydrodynamic drive shifted generally to the southwest, moving crustally trapped oil back down the western flanks of the Laramide structures and washing away the lighter hydrocarbon fractions by the influx of fresh water (Allin, 1990). This phenomenon is observed at Upper Valley field where the hydrodynamic drive has offset oil to the western flank and the southern plunge of the structure. The oil/water contact in all zones is tilted S. 45° W. and appears curvilinear, concave down, due to a decrease in oil gravity (Sharp, 1978). Very little solution gas remains in the oil.

Most wildcat wells in the monument have been drilled on the crests of the major structures. Because of the hydrodynamic drive in the region, the potential traps on the flanks of the structures remain to be tested. Oil fields similar to Upper Valley have been discovered in Wyoming and California. Studies of these areas and methods used in their evaluation can help to determine the location of hydrodynamically-displaced oil in the monument.

Exploration and Development

Forty-seven wildcat wells have been drilled within the monument; 24 in Garfield County and 23 in Kane County, respectively. Petroleum shows have been found in Triassic, Permian, Pennsylvanian, Mississippian, Devonian, and Cambrian age rocks (Doelling, 1975). These shows were in the form of petroleum recovered from drill-stem or production tests in wells and live oil stains or bitumen in drilling cuttings. Sixty-three percent of the wells drilled in the monument tested only the Permian section, the Kaibab Limestone being the main target. Just five wells tested the Mississippian and Devonian sections, and only three penetrated the Precambrian.

Drilling History

The large surface anticlines within the monument sparked the interest of wildcatters in the early days of petroleum exploration in the West. The first well in the monument was drilled on the large Circle Cliffs anticline by the Ohio Oil Company in 1921. The No. 1 Circle Cliffs (section 25, T. 34 S., R. 7 E., Salt Lake Base Line) penetrated the Mississippian Redwall Limestone (figure 4), but no shows of oil or gas were reported and the well was plugged after reaching a total depth of 3,212 feet. In 1930, Midwest Exploration Company tested the Butler Valley anticline along the north plunge of the Kaibab uplift in the center of the Kaiparowits basin (now part of the monument). The No. 1 Parry well (section 14, T. 39 S., R. 1 W., Salt Lake Base Line) reached a total depth of 4,436 feet in the Permian Cedar Mesa Sandstone. Although good shows of oil were encountered in the Kaibab Limestone and Toroweap Sandstone, the well was abandoned (Montgomery, 1984). No other exploratory wells were drilled in the monument for the next 20 or so years.

Seven wildcats were drilled in the area which is now the monument the 1950s. In 1954, Hunt Oil Company drilled the second well on the Circle Cliffs anticline, the No. 1 Government (section 24, T. 34 S., R. 7 E., Salt Lake Base Line), which reached a total depth of 5,620 feet in the Bright Angel Shale above the Tapeats Sandstone. The well was plugged with no shows reported. The Tidewater Gulch No. 1, discussed earlier, was drilled in 1956 to a total depth of 6,253 feet. Several shows of oil were reported throughout the Cambrian section. A drill-stem test of the Tapeats Sandstone recovered 270 feet of gas-cut mud.

The greatest flurry of exploration activity took place during the 1960s and 1970s, when 32 wells were drilled in the area that is now the monument. In 1977, considerable interest was sparked by the reported Kaibab oil discovery in the Houston Oil and Minerals No. 11-9 Relsihen Federal well (section 9, T. 38 S., R. 3 E., Salt Lake Base Line). Drilled as a 10,285 foot Mississippian test on the Rees anticline in the center of the monument, this well only pumped one barrel of oil per day and was abandoned as non-commercial (Montgomery, 1984).

Only three wells were drilled in the 1980s but interest was renewed in 1994 with two wildcats designed to test the Precambrian-source oil play. On the Paria Plateau along the southern Kaibab uplift, Burnett Oil Company drilled the No. 1-36 Kaibab well (section 36, T. 43 S., R. 3 W., Salt Lake Base Line) to a total depth of 5,362 feet. The Precambrian was penetrated at 4,780 feet after which 585 feet of sedimentary rocks, possibly the Dox Sandstone, were penetrated (verbal communication, David Allin, 1997). The Tapeats Sandstone measured 106 feet thick, and although some shows were reported, the well was abandoned without any tests. The other well drilled in 1994, the BHP Petroleum No. 1-28 Federal (discussed

earlier) on the Circle Cliffs anticline, reached a total depth of 6,185 feet. The Precambrian was penetrated at 6,130 feet but consisted of phyllite; no sedimentary rocks were encountered. The Tapeats measured 212 feet thick and contained bitumens. The presence of bitumens implied the Tapeats received a hydrocarbon charge prior to the influx of CO_2 (Uphoff, 1997). The well was plugged after the CO_2 tests.

Upper Valley Field

The Upper Valley field was discovered in 1964 when Tenneco Oil Company drilled the No. 2 Upper Valley Unit well (section 13, T. 36 S., R. 1 E., Salt Lake Base Line) near the monument's north-central boundary. That well pumped 300 barrels of oil per day out of the Kaibab Limestone along the flank of the north-northwest-trending part of the Upper Valley anticline (figure 4). The productive area covered 3,350 acres with an average net pay thickness of 75 feet (Sharp, 1978; Allin, 1993). The trapping mechanism and reservoir characteristics were described in previous sections and are summarized in detail by Campbell (1969), Peterson, (1973), Sharp (1976, 1978), Montgomery (1984), and Allin (1990, 1993).

The Upper Valley field has produced 25,144,770 barrels of oil, ranking it as the ninth-largest oil field in Utah in terms of total production (Utah Division of Oil, Gas and Mining, 1996). Citation Oil & Gas Corporation is the current operator of the 22 active wells in the field. Five of these wells lie within the monument and accounted for nearly 27 percent of the field production in September 1996, and 10 percent of the total cumulative field production (table 4) (Utah Division of Oil, Gas and Mining, 1996). In total, the monument wells would be ranked as the eighteenth-largest field in Utah in terms of cumulative production.

In addition to the producing wells, there are two water injection wells within the monument. These wells are part of a 10-well peripheral waterflood program begun in 1969 by the field operators and designed as a secondary recovery program. Over 10 million barrels of produced water are injected annually back into the reservoir to maintain pressure and increase oil recovery.

The Upper Valley field as designated by the Utah Division of Oil, Gas and Mining includes about 2,000 acres within the monument (figure 12). The federally-recognized Upper Valley Federal Unit includes about 1,840 acres within the monument. These areas include access roads, tank batteries, gathering systems, and other maintenance facilities necessary to operate this large field. As there are no oil or gas pipelines in the region, all of the oil is trucked 300 miles to refineries in Salt Lake City.

Sharp (1978) estimated the ultimate recovery from Upper Valley field as about 21 million barrels of oil. Allin (1993) estimated the ultimate recovery as 25 million barrels of oil. That amount was exceeded in 1996 and monthly production continues to average more than 20,000 barrels of oil. Tertiary recovery techniques and new technologic advances in enhanced oil recovery should help maintain Upper Valley field as a major contributor to oil production in Utah.

Carbon Dioxide

Carbon dioxide (CO_2) is present in many large anticlines throughout the Colorado Plateau. Closest CO_2 production to the monument is in the McElmo Dome field in southwestern Colorado, where gas is transported via a 502-mile pipeline to west Texas for enhanced oil-recovery programs. The gas is also piped to southeastern Utah for the state's only CO_2-enhanced oil-recovery operation at Greater Aneth field.

In 1960 and 1961, wells drilled by Phillips Petroleum tested CO_2 from Permian and Triassic rocks on the large, northwest-trending Escalante anticline which extends into the northern part of the monument near the town of Escalante (figure 4). Mid-Continent drilled the Charger No. 1 well (section 29, T. 32 S., R. 3 E.) to a depth of 3,443 feet within the structure in 1983. Gas flowed at a rate as high as 12.4 million cubic feet per day over an effective pay interval of 2,000 feet (Montgomery, 1984). Reservoirs in this well include the Permian Cedar Mesa Sandstone, Toroweap Formation, Kaibab Limestone (Black Box Dolomite in the northeast part of the monument), and the Triassic Moenkopi and Chinle Formations. The gas from the Charger well is composed of 93 to 99 percent CO_2, 1 to 6 percent nitrogen (N_2), and 0.4 to 0.7 percent methane (CH_4) (Moore and Sigler, 1987). Reserve estimates range from 1.5 to 4.0 trillion cubic feet of gas (Petroleum Information, 1984). However, tests performed on two wells in 1986 indicated a much smaller CO_2 reservoir.

The thick sections of Paleozoic carbonate rocks in the region are the probable CO_2 source-rocks. Metamorphism of marine carbonates by the heat of nearby igneous intrusive rocks likely generated the high concentrations of CO_2 found in the Escalante anticline. Carbon dioxide may also have been produced by the reaction of hot, acidized ground water with the carbonate rocks, or the heating of kerogen-bearing (source) rocks (Petroleum Information, 1984). Extensive Tertiary, volcanic rocks covering large areas

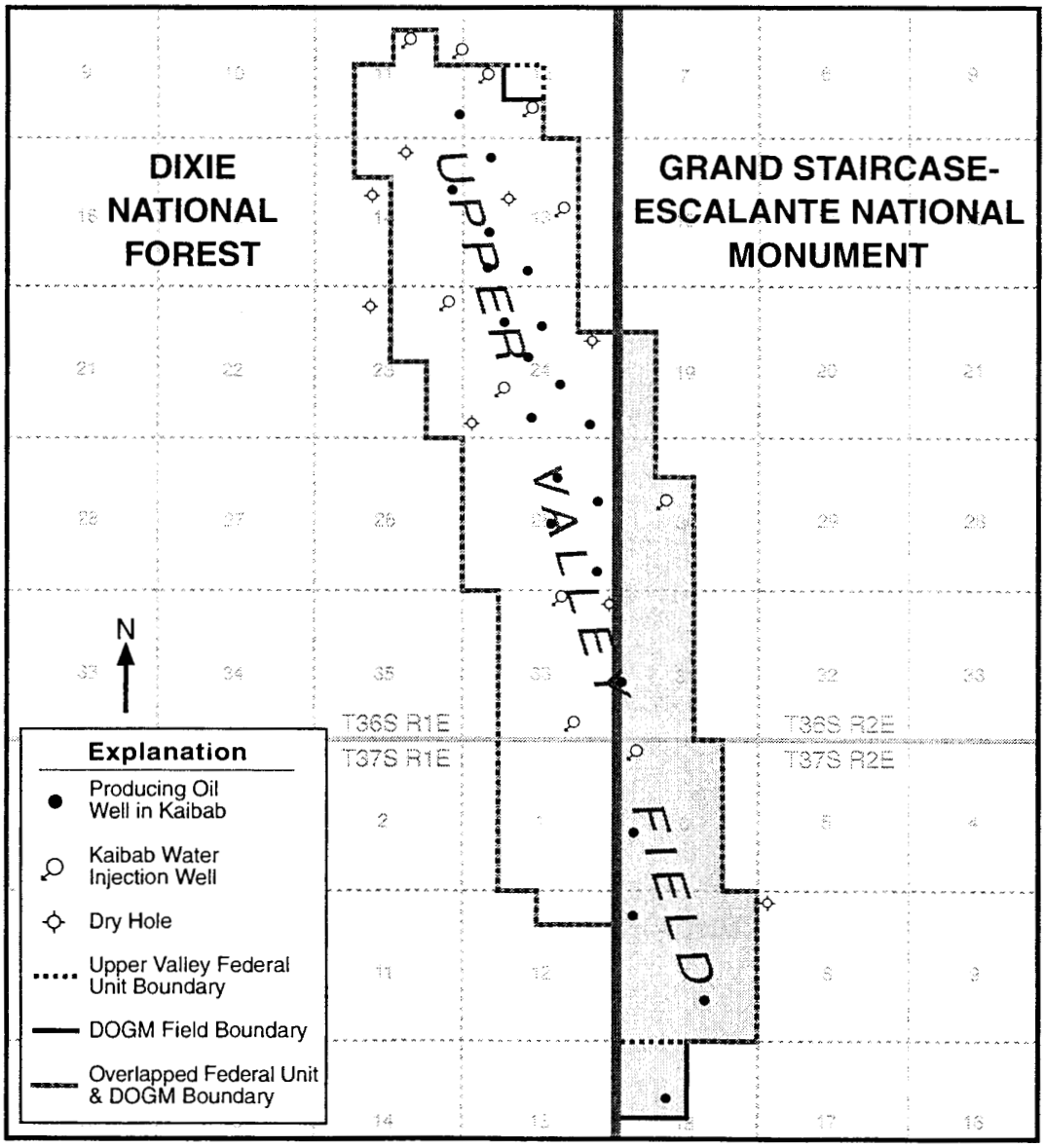


Figure 12. *Upper Valley field boundary as designated by the Utah Division of Oil, Gas and Mining, and by the Bureau of Land Management. Shading denotes part of field in monument (prepared by Mike Hebertson, Utah Division of Oil, Gas and Mining).*

Table 4. Oil and water production from the Grand Staircase - Escalante National Monument portion of Upper Valley field as compared to the field as a whole (Utah Division of Oil, Gas and Mining, 1996).

Location	Active Wells	Monthly Production (bbls)		Cumulative Production (bbls)		Field Production (%)	
		Oil	Water	Oil	Water	Monthly	Total
Within Monument	5	5,544	185,790	2,472,951	48,325,057	26.9	9.8
Outside Monument	17	15,059	686,040	22,671,819	307,536,233	73.1	90.2
Total Upper Valley	22	20,603	871,830	25,144,770	355,861,290	100.0	100.0

of the High Plateaus and parts of the Kaiparowits basin implies intrusions of high-level Tertiary plutons. These plutons probably acted as heat sources. The modern heat flow in the region ranges between 1.5 and 2.5 heat flow units (Lachenbruch and Sass, 1980).

The Upper Valley anticline, situated a few miles to the west and parallel to the Escalante anticline (figure 4), contains some accumulations of CO_2 trapped as a gas cap above the oil reservoir. On the Circle Cliffs anticline, a drill-stem test of the Tapeats Sandstone in BHP's Circle Cliffs No. 28-1 Federal well had an initial flow rate of 5.0 million cubic feet of gas per day, and contained no water. The gas was composed of 98 percent CO_2 and 1.5 percent nitrogen (Uphoff, 1997).

Although the Circle Cliffs deposit may be of the same order of magnitude as the Escalante deposit, this and other potential CO_2 resources in the monument will likely remain undeveloped. Ample supplies of CO_2 are available from other state states. Moreover, there are few planned CO_2-enhanced oil-recovery projects in Utah.

Further Oil and Gas Resource Assessments Needed

The evaluation of potential petroleum resources presented for the monument in this report are based on a very limited amount of information. To prove the presence or absence of Precambrian-source and hydrodynamically displaced oil would require the following: (1) acquire new and compile existing seismic data, conduct a thorough interpretation of the data, and construct detail maps defining the extent of Chuar source rocks as well as the locality of rift fault blocks where Chuar could be preserved; (2) produce detailed structural contour maps for each potential reservoir to identify subsidiary closures along major anticlines; (3) conduct additional typing of produced oils and matching of those oils to known or potential source rocks in the monument and surrounding regions; (5) model the basic source rock parameters of these formations to determine, qualitatively, hydrocarbon generation-migration timing; (6) calculate petroleum volumetrics for each of the potential rocks; and (7) further refine the hydrodynamic characteristics of the Kaiparowits basin to determine the most likely locations of displaced oil along the major structures.

In the final analysis, however, Precambrian-source and hydrodynamically displaced oil in the monument can only be proved by drilling exploratory wells and using state-of-the-art techniques to develop any petroleum resources discovered. Three unsuccessful wells penetrating the Precambrian and another 44 plugged wells in shallower targets cannot be used alone to rule out the possibility of major petroleum accumulations in the monument.

TAR-SAND RESOURCES OF THE CIRCLE CLIFFS AREA

The Circle Cliffs tar-sand deposit, located in T. 33 through 36 S., R. 6 through 9 E., central Garfield County, is in the eastern part of the monument (figure 13). The deposit is entirely contained within the monument and Capitol Reef National Park and is about 40 miles south-southeast of the park's visitors' center. Access to the area is by the Burr Trail road from either Capitol Reef National Park or the town of Boulder. In 1981 the Federal government designated the Circle Cliffs deposit a Special Tar Sand Area (STSA) in accordance with the Combined Hydrocarbon Leasing Act. This designation as an STSA permits development of the tar-sand resource by allowing

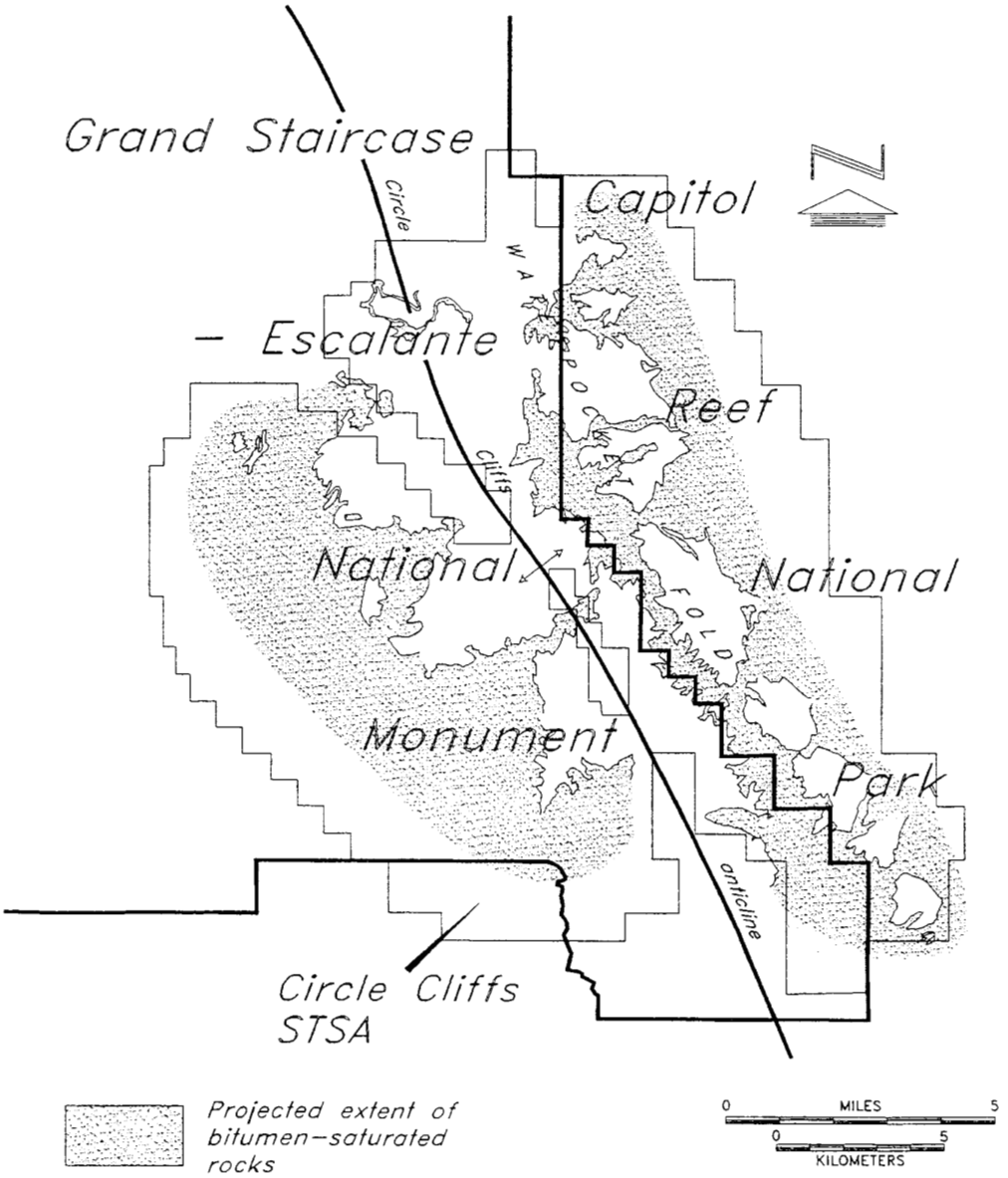


Figure 13. Tar-sand resources in the Circle Cliffs Special Tar Sand Area (STSA).

conversion of oil and gas leases to combined hydrocarbon leases within the STSA.

Tar sands is a catch-all term which includes asphaltic sandstone, bituminous sandstone, pitch rock, oil-impregnated sandstone, heavy-oil sand, and oil sand. The U.S. Department of Energy defines tar sands as any rock (other than coal, oil shale, or gilsonite) that contains oil with a gas-free viscosity greater than 10 Pascal seconds, or 10,000 centipoise, at original reservoir temperatures. Tar sands are the result of oil-migration from source rocks, accumulation in reservoir rocks, and subsequent degradation over time with exposure to oxygenated ground water, bacteria, and other nutrients. Conventional oil-field techniques cannot recover the oil in tar sands because it has little mobility at reservoir conditions. Processes developed to liberate hydrocarbons from tar sand usually involve crushing and washing the mined material using hot water, steam, or chemical solvents.

Active interest in the Circle Cliffs tar-sand deposits might have started as early as the 1920s, when the Ohio Oil Company, undoubtably encouraged by the oil shows in the Moenkopi Formation, drilled the first test near the axis of the structure. There is no known development of the tar sands deposits, although there have been applications made to the BLM for combined hydrocarbon leases.

The Circle Cliffs is a large, breached anticline that is approximately 9 miles wide and 30 miles long with a steep eastern flank, the Waterpocket Fold, and a shallow dipping west flank. The structure trends north-south and is distinctly asymmetrical. The structural axis of the anticline is located along the eastern boundary of the monument. Davidson (1967) indicated an anticlinal closure of about 1,200 feet. Only minor faulting, with displacement from a few feet to more than 100 feet, is associated with the anticline, mostly west of the anticlinal axis. The breached part of the anticline is marked by a topographic depression with isolated buttes and mesas standing as erosional remnants more than 300 feet above the floor of the depression.

Blakey (1977) and Ritzma (1980) described the tar sands of the Circle Cliffs as contained in low-porosity sandstones in the upper part of the Torrey and Moody Canyon Members of the Moenkopi Formation. These deltaic and fluvial sandstones range from 3 to 90 feet thick and are repeated in the vertical section. Normally the rocks are brownish red, but because of oil saturation, the rocks can be light grayish red to light gray to light yellow. Thickness of the oil-saturated rock ranges from a few feet on the margins of the deposits to over 200 feet. Oil apparently migrated to the structurally highest part of the trap within sandstones of the Moenkopi Formation. The deposit shows evidence of hydrodynamic offset; the thickest section of oil-saturated rock is offset from the crest of the anticline. Upward movement of the oil was stopped by less permeable layers of rocks in the Moenkopi Formation. The oil was eventually exposed to oxygenated meteoric water that carried bacteria into the reservoir. This resulted in biodegradation, loss of volatiles, and oxidation of the lighter oil fractions, increasing the gravity and viscosity of the residue. Eventually the anticline was breached by erosion dividing the deposit into the western and eastern flanks (Ritzma, 1980). The entire western flank and a small part of the eastern flank of the deposit are within the monument.

Since no study has systematically evaluated all possible sources of the oil accumulation in the Circle Cliffs, the origin of the oil is uncertain. Proposed sources for the oil include the Lower Triassic Sinbad Limestone Member of the Moenkopi Formation, the Lower Permian Kaibab Formation, and Paleozoic rocks (Blakey, 1977; Ritzma, 1980). Sanford (1995) suggests that, in addition to the Moenkopi and Kaibab Formations, potential source rocks include the Precambrian Chuar Group and the Paleozoic Toroweap Formation. Many wells that penetrate the Moenkopi Formation in central Utah record some type of oil show in the Moenkopi Formation. Free oil shows in cores, on drill-stem tests, during drilling, on wire line tools, and on completion attempts are common from the Moenkopi Formation throughout central Utah, suggesting a long migration path (Mitchell and others, 1989).

Ritzma (1980) estimated in-place tar-sand resources of 1.3 billion barrels (447 million barrels on the western flank and 860 million barrels on the eastern flank) for the Circle Cliffs deposit. Samples analyzed have yielded 5.0 to 27.0 percent oil. Based on Ritzma's (1979) estimate, in-place tar-sand resources for the part of the Circle Cliffs deposit inside the monument could be as much as 550 million barrels of oil.

NON-FUEL MINERALS AND MINING

Various types of metallic-mineral deposits are known to be present in the monument (figure 14). Most of these are small and low-grade with an uncertain likelihood of significant development. However, several areas contain known or potential deposits that might be of developable size and grade. Several of these deposits contain minerals or commodities, such as rutile and zirconium, that are considered to be strategic and critical minerals. Minor occurrences of other

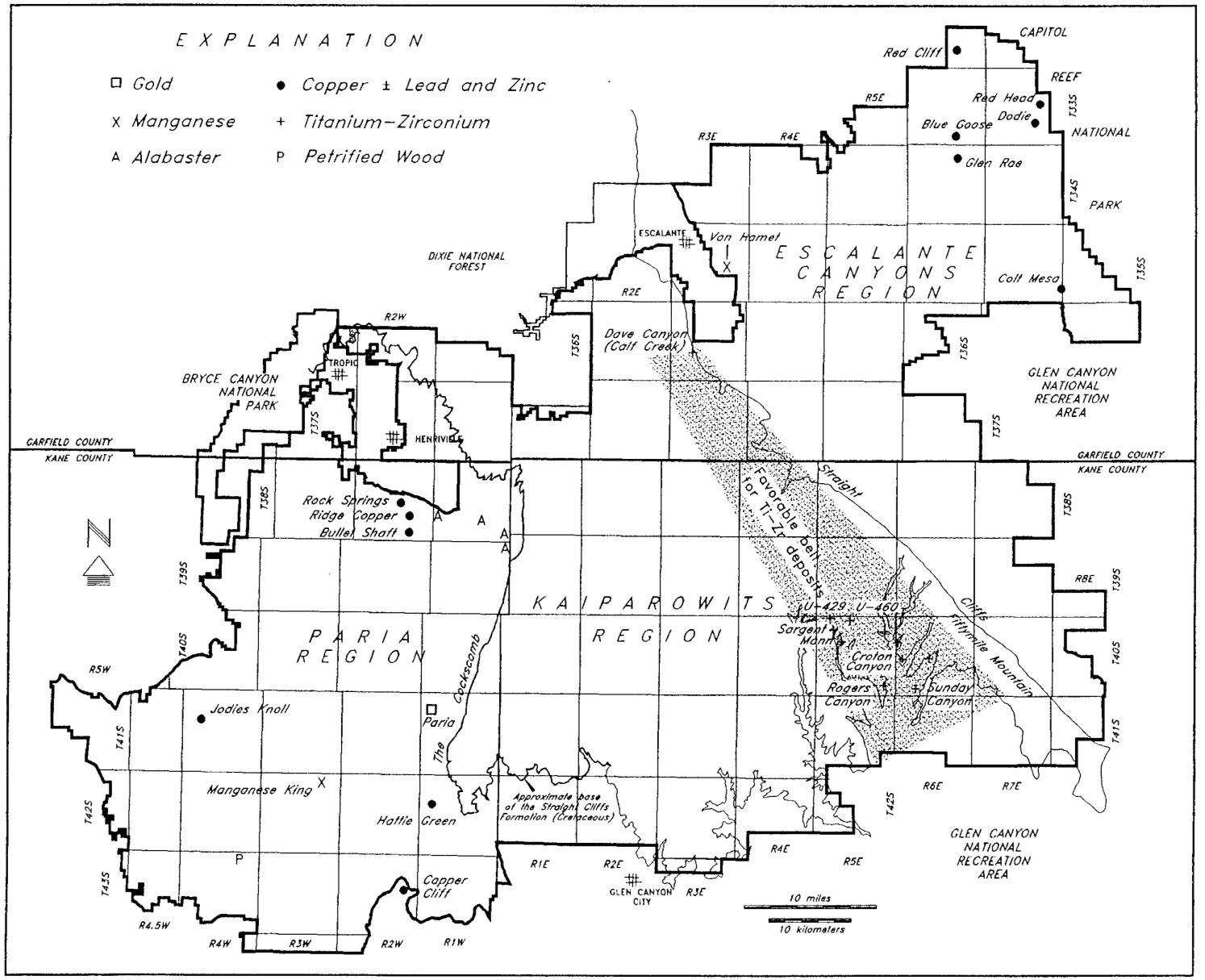


Figure 14. Non–fuel minerals in the Grand Staircase – Escalante National Monument.

minerals such as manganese, copper, and uranium are also present in the monument but are probably not commercial quality due to low, often sub-economic grades and limited tonnage.

Manganese

Manganese was mined in the 1940s from the Manganese King Mine on the north side of Kitchen Corral Wash west of The Cockscomb (figure 14). The manganese deposits occur in the middle part of the Petrified Forest Member of the Chinle Formation. Manganese is contained over a stratigraphic thickness of 17 feet but most is concentrated in a 6- to 12-inch-thick-zone (Doelling and Davis, 1989). The occurrences can be traced laterally for about 1,000 feet. Total production was about 300 to 400 tons of ore containing 40 percent manganese. Descriptions of the deposit, workings, and history of production are presented in Buranek (1945), Havens and Agey (1949), Baker and others (1952), and Doelling and Davis (1989).

Manganese is also found at the Van Hamet prospect located a few miles southeast of Escalante (figure 14). The manganese occurs as lenticular pods and concretions in sandstone of the Jurassic Carmel Formation. The pods are up to 1 foot thick and scattered in an area 100 by 250 feet. Select samples are low grade, only 15 to 27 percent manganese (Doelling, 1975).

Uranium-Vanadium

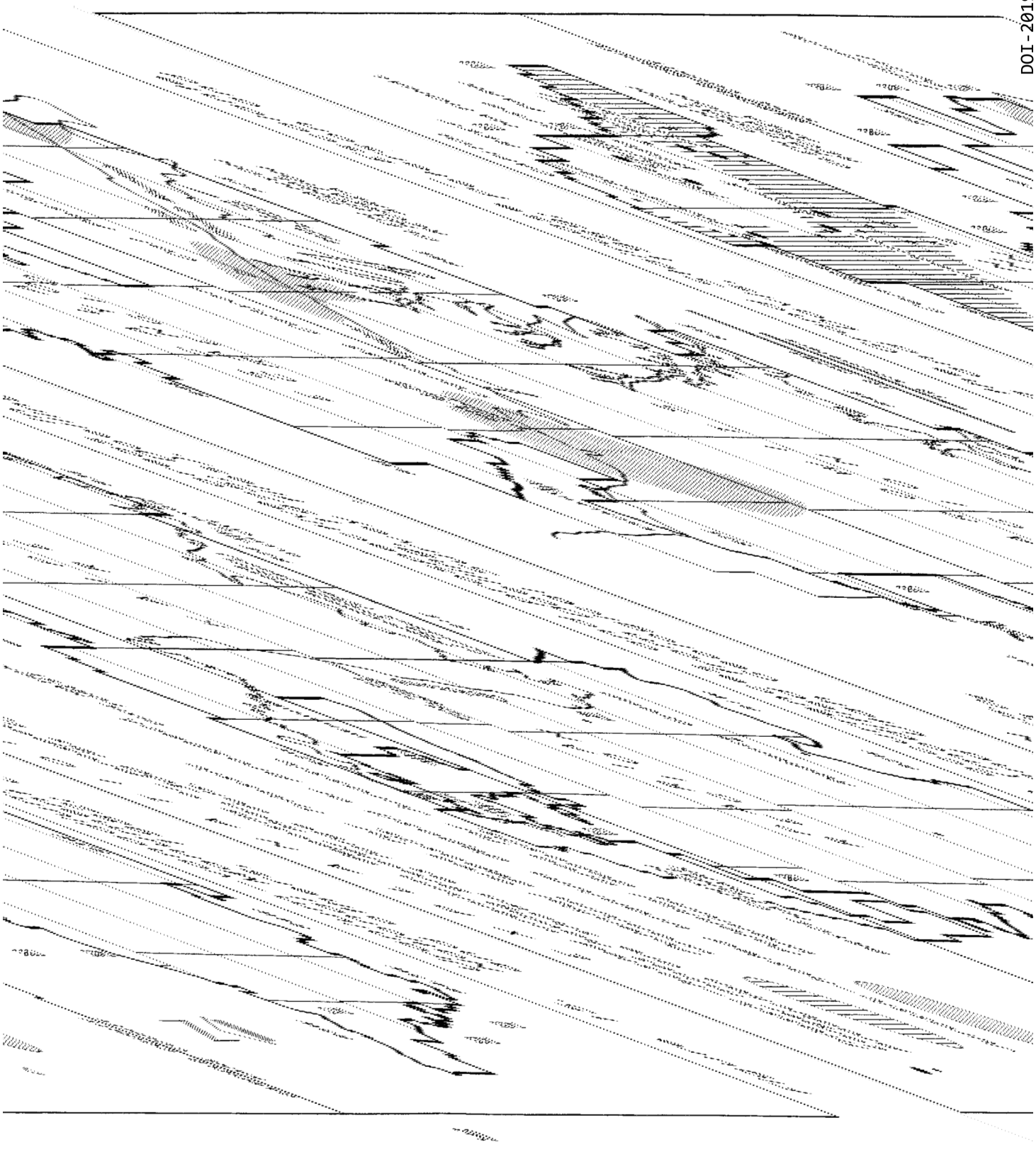
Uranium deposits or prospects with associated vanadium or copper are present in several areas within the monument. The deposits and prospects occur in either the Triassic Moenkopi and Chinle Formations or the Jurassic Morrison Formation. The Triassic-hosted occurrences are in the extreme northeast portion of the monument in Circle Cliffs area and in the southwestern part of the monument near The Cockscomb. The Jurassic-hosted occurrences are in the east-central part of the monument along Fiftymile Bench. Additional Jurassic-hosted deposits are present immediately east of and outside of the monument along the eastern flank of the Circle Cliffs anticline. Most of the prospects are small and the only mines that produced more than 200 pounds of U_3O_8 were in Triassic host rocks in the Circle Cliffs area.

Triassic-hosted Deposits

At least 29 uranium prospects containing subordinate copper as well as seven copper mines and prospects are present in the portion of the Circle Cliffs uplift within the monument (figure 15). The deposits occur mostly in and adjacent to channels in the Shinarump Member of the Chinle Formation in either basal sandstones and conglomerates of the Shinarump or in sandstones or siltstones of the underlying Moenkopi Formation. Nearly 85 percent of the estimated 75,000 pounds of uranium produced in the Circle Cliffs area came from the Rainy Day, Horsehead, and Centipede mines (Doelling, 1975; Utah Geological Survey, unpublished file data). The Rainy Day mine is outside of the monument. Although vanadium generally is not important in Chinle-hosted deposits, an estimated 35,000 to 37,000 pounds of V_2O_5 were produced from the Circle Cliffs area, almost all from the Rainy Day mine (Doelling, 1975). Typical grades for most of the deposits are from 0.05 to 0.20 percent U_3O_8 and 0.5 to 3.0 percent copper. Anomalous amounts of lead, zinc, cobalt, nickel, molybdenum, silver and yttrium are associated with some of the deposits often as sulfides or secondary oxides forming a halo around or above the uranium mineralization. Of the associated elements, only copper is sufficiently abundant to be considered a by-product of uranium mining. Most previous exploration for Chinle-hosted deposits in the Circle Cliffs area has not extended more than a few hundred feet beyond the outcrop. Additional resources may lie along western extensions of channels containing the Centipede and Horsehead mines, but the expected uranium grade would still be only 0.10 to 0.20 percent U_3O_8.

Doelling and Davis (1989) reported four areas of anomalous radioactivity in the Chinle Formation in the Cockscomb-Buckskin Mountain area (figure 15). Surface cuts and short adits have been used to explore these areas but no uranium minerals were identified. Most occurrences are in iron-oxide stained, commonly bleached, sandstones of the Shinarump or Monitor Butte Members of the Chinle Formation close to the contact with the underlying Moenkopi Formation.

Uranium mineralization also occurs in the Kayenta Formation at the Radiance Group southeast of The Cockscomb (figure 15). Workings consisted of several adits and inclines later destroyed by mining of sandstone for highway construction (Doelling and Davis, 1989). The mineralization consists of secondary uranium and copper minerals coating fractures in the Kayenta Formation. About 173 pounds of uranium were produced from ores containing 0.15 to 0.25



percent U_3O_8. The remaining resource, if any, is probably small (Doelling and Davis. 1989)

Potential for Chinle-hosted deposits in other parts of the monument is thought to be low (Dubyk and Young, 1978).

Jurassic-hosted Deposits

Within the monument, the Morrison Formation is exposed as a narrow zone along The Cockscomb, as a slightly broader zone along Fiftymile Bench below the Straight Cliffs, and as a yet broader zone along the southern edge of the Kaiparowits Plateau. Anomalous radioactivity has been detected along a 3- to 4-mile-long-zone along the eastern side of Fiftymile Mountain. A small adit (Steele prospect at Cat Pasture) is driven in a sandstone channel in the Morrison Formation here (figure 15). Samples from this prospect contained 0.014 and 0.033 percent U_3O_8 but only minor vanadium (Utah Geological Survey, unpublished file data). Doelling and Davis (1989) believe a substantial tonnage of very low-grade uranium (0.01 to 0.05 percent U_3O_8) could be found at Cat Pasture (figure 15).

Peterson and others (1982) identified two additional areas thought to be favorable for Morrison-hosted uranium deposits based on depositional environment, thickness, and structure. These two areas are near Fiftymile Point and Carcass Canyon (figure 15). Although these two areas have favorable geology, no uranium has yet been identified.

Zirconium-Titanium

A number of heavy mineral fossil placer deposits are present in the John Henry Member of the Cretaceous Straight Cliffs Formation within the central portion of the monument. The deposits are undeveloped at present due to their remote location, and due to problems associated with producing a mineral concentrate. However, these placer deposits represent a significant zirconium-titanium resource that could be potentially commercial.

The deposits occur in a 40- to 50-mile-long-belt extending from just south of Escalante (Dave Canyon) to the middle of Kane County (Sunday Canyon, figure 14). The northern occurrences are between the Alvey and Christensen coal seams and the southern occurrences are below the Christensen coal seam, suggesting the presence of multiple heavy mineral horizons.

The deposits are fossil beach placers containing variable amounts of zircon, ilmenite, magnetite, rutile, monazite, and some silicates. The heavy-mineral horizons are from 4 to 15 feet thick, and as much as 400 feet wide and 1,500 feet long. The deposits are "high grade," contain from 18 to 45 percent "ilmenite-equivalent," 4 to 14 percent zircon, and 1 to 4 percent monazite. Recent work indicates that from 10 to 50 percent of the titanium is contained in the mineral rutile (Carpco Inc., 1987). Rutile is considered to be a strategic and critical mineral and sells for about $600 per ton. Zircon is also a stockpiled critical and strategic mineral and sells for $350 to $400 per ton. The deposits are high grade (20 to 60 percent) when compared to recent heavy-mineral, beach placers that typically contain only 10 to 15 percent heavy minerals.

At least 14 individual deposits are known within the Ti-Zr belt within the monument (figure 14) with an estimated aggregate size of from 1.04 million tons (Dow and Batty, 1961) to 3.06 million tons (Mountain States Resources, 1988). Because of problems associated with producing a salable concentrate, the economic viability of the deposits is uncertain.

Gold

Anomalous gold values are reported for Permian to Jurassic sedimentary rocks over much of southeastern Utah, particularly in the Chinle and Wingate Formations and in the Navajo Sandstone (Butler and others, 1920; Gregory and Moore, 1931; Phillips, 1985). Lawson (1913) reported several early attempts to mine the gold in the Chinle Formation at Paria by hydraulic methods. All were unsuccessful.

Copper, Lead and Zinc

Copper, often with associated lead, zinc, and silver, occurs in sedimentary host units in four separate areas within the monument (figure 14). The Rock Springs, Ridge Copper, and Bullet Shaft deposits are located south of Kodachrome Basin. These deposits lie on the east side of the north-plunging Kaibab anticline (Kaibab Uplift) and occur in the Jurassic Thousand Pockets Tongue of the Page Sandstone. Workings consist of surface pits, shallow shafts, and short adits. The ore occurs as irregularly shaped pods a few feet in length, nodules, and impregnations in sandstone. The Ridge Copper and Bullet Shaft were mined for copper but the Rock Spring deposit was mined mostly for lead (Doelling and Davis, 1989).

Copper, lead, and zinc are associated with a number of uranium deposits in the Circle Cliffs area. Uranium mines containing significant copper values include the Blue Bird, Black Widow, Yellow Jacket,

Hot Shot, Sneaky, and Rainy Day mines In addition, a number of mines and prospects contain mostly copper with little or no associated uranium. In both the copper and uranium-copper mines, the copper occurs as malachite, azurite, bornite, and chalcopyrite in discontinuous zones generally 1 to 3 feet thick in basal sandstones of the Shinarump and in the uppermost Moenkopi Formation. Trace amounts of cobalt and molybdenum are associated with these deposits.

Copper mineralization is found along a zone extending 12 miles northward from the Arizona border along the East Kaibab monocline. The mineralization is associated with fractures subparallel to regional folds. Copper oxide minerals with some associated sulfide minerals occur in fractures in the Jurassic Navajo Sandstone and Moenave Formation, and in the Triassic Shinarump Member of the Chinle Formation. Most mineralized fractures are small, extending only a few feet along strike, with the largest extending for several hundred feet. Prospects include Copper Cliff and Hattie Green, where Doelling and Davis (1989) reported several pits, adits, and small stockpiles of material they suspect were shipped for test smelting.

Copper-silver mineralization is found at Jodies Knoll near Montezuma. Mineralization is present as weak malachite and iron oxide staining in the Thousand Pockets Tongue of the Jurassic Page Sandstone. The mineralization is exposed over an area 400 to 500 feet long but is very erratic (Davis and Doelling, 1989).

Industrial and Construction Materials

Because there has been negligible production of industrial mineral materials within the monument, and because these materials are widely available in commercial operations elsewhere, we describe them briefly here. Industrial and construction materials in the monument include sand and gravel, limestone, gypsum, building stone, clays, and glass sand. Sand and gravel deposits used for concrete and road construction are located adjacent to the Paria River and Wahweap Creek drainages in the western and southern parts of the monument. No limestone deposits in the monument have produced material for industrial applications, although several formations, ranging in age from Permian to Tertiary and exposed in the western part, contain limestone of possible commercial quality and quantity. Likewise, rock units exposed in the western part of the monument, particularly units in the Moenkopi, Moenave, and Carmel Formations, have historically provided building stone for local uses. Gypsum is abundant in the Moenkopi and Carmel Formations inside the monument, but no deposits have been developed. Clay units occur throughout the exposed stratigraphic section particularly in the Chinle and Dakota Formations, and in the Tropic Shale. Sand for industrial uses is also widespread throughout the monument, however, the only unit investigated has been the Navajo Sandstone (Doelling and Davis, 1989).

Mining Activity

There are five small mining operations currently permitted within the monument according to records at the Utah Division of Oil, Gas and Mining. Four of the operations are active quarries for alabaster. The fifth is a suspended operation that supplied petrified wood. The operators of the quarries primarily gather material that weathers out of the rock rather than actively quarrying the materials. One of the alabaster quarries lies on both federal and School Trust lands. The alabaster is reputed to be among the best available in the country for sculpting purposes. Annual production is about 300 tons and the wholesale price is $500 per ton ($150,000 per year). The retail price is approximately $2,500 per ton. Individual large pieces can sell for $2,000 to $6,000 each (Brad Orrin, verbal communication, 1996). Over a 30-year period, these quarries should generate $4.5 million in production.

Further Non-Fuel Mineral Resource Assessments Needed

Additional surface mapping in conjunction with a limited drilling program at the Manganese King mine would refine the estimates of the size and grade of the remaining manganese resource estimated by Buranek (1945) at 20,000 tons.

There is little information on the uranium resources down dip on the western side of the Circle Cliffs uplift. Additional uranium resources are likely along the western continuations of Shinarump channels hosting the Centipede and Horsehead mines. Drilling (less than 300 feet) would be required to discover and evaluate the uranium mineralization which would most likely be small (less than 3,000 to 4,000 tons) and low grade (0.10 to 0.20 percent U_3O_8).

The size, extent and grade of the titanium-zirconium placers are not well defined. The extents of exposed occurrences are not adequately known and the size and grade of the expected "blind" occurrences are purely speculative. Additional surface mapping, extensive sampling and some drilling would be required to determine the tonnage, grade and rutile/ilmenite ratios of the known occurrences. Stratigraphic studies,

surface geophysical surveys, and drilling would be required to determine the subsurface extent of deposits.

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APPENDIX A: Presidential proclamation

THE WHITE HOUSE

Office of the Press Secretary

For Immediate Release
September 18, 1996

ESTABLISHMENT OF THE GRAND STAIRCASE-ESCALANTE NATIONAL MONUMENT

By the President of the United States of America

A Proclamation

The Grand Staircase-Escalante National Monument's vast and austere landscape embraces a spectacular array of scientific and historic resources. This high, rugged, and remote region, where bold plateaus and multi-hued cliffs run for distances that defy human perspective, was the last place in the continental United States to be mapped. Even today, this unspoiled natural area remains a frontier, a quality that greatly enhances the monument's value for scientific study. The monument has a long and dignified human history: it is a place where one can see how nature shapes human endeavors in the American West, where distance and aridity have been pitted against our dreams and courage. The monument presents exemplary opportunities for geologists, paleontologists, archeologists, historians, and biologists.

The monument is a geologic treasure of clearly exposed stratigraphy and structures. The sedimentary rock layers are relatively undeformed and unobscured by vegetation, offering a clear view to understanding the processes of the earth's formation. A wide variety of formations, some in brilliant colors, have been exposed by millennia of erosion. The monument contains significant portions of a vast geologic stairway, named the Grand Staircase by pioneering geologist Clarence Dutton, which rises 5,500 feet to the rim of Bryce Canyon in an unbroken sequence of great cliffs and plateaus. The monument includes the rugged canyon country of the upper Paria Canyon system, major components of the White and Vermillion Cliffs and associated benches, and the Kaiparowits Plateau. That Plateau encompasses about 1,600 square miles of sedimentary rock and consists of successive south-to-north ascending plateaus or benches, deeply cut by steep-walled canyons. Naturally burning coal seams have scorched the tops of the Burning Hills brick-red. Another prominent geological feature of the plateau is the East Kaibab Monocline, known as the Cockscomb. The monument also includes the spectacular Circle Cliffs and part of the Waterpocket Fold, the inclusion of which completes the protection of this geologic feature begun with the establishment of Capitol Reef National Monument in 1938 (Proclamation No. 2246, 50 Stat. 1856). The monument holds many arches and natural bridges, including the 130-foot-high Escalante Natural Bridge, with a 100 foot span, and Grosvenor Arch, a rare "double arch." The upper Escalante Canyons, in the northeastern reaches of the monument, are distinctive: in addition to several major arches and natural bridges, vivid geological features are laid bare in narrow, serpentine canyons, where erosion has exposed sandstone and shale deposits in shades of red, maroon, chocolate, tan, gray , and white. Such diverse objects make the monument outstanding for purposes of geologic study.

The monument includes world class paleontological sites. The Circle Cliffs reveal remarkable specimens of petrified wood, such as large unbroken logs exceeding 30 feet in length. The thickness, continuity and broad temporal distribution of the Kaiparowits Plateau's stratigraphy provide significant opportunities to study the paleontology of the late Cretaceous Era. Extremely significant fossils, including marine and brackish water mollusks, turtles, crocodilians, lizards, dinosaurs, fishes, and mammals, have been recovered from the Dakota, Tropic Shale and Wahweap Formations, and the Tibbet Canyon, Smoky Hollow and John Henry members of the Straight Cliffs Formation. Within the monument, these formations have produced the only evidence in our hemisphere of terrestrial vertebrate fauna, including mammals, of

the Cenomanian-Santonian ages. This sequence of rocks, including the overlaying Wahweap and Kaiparowits formations, contains one of the best and most continuous records of Late Cretaceous terrestrial life in the world.

Archeological inventories carried out to date show extensive use of places within the monument by ancient Native American cultures. The area was a contact point for the Anasazi and Fremont cultures, and the evidence of this mingling provides a significant opportunity for archeological study. The cultural resources discovered so far in the monument are outstanding in their variety of cultural affiliation, type and distribution. Hundreds of recorded sites include rock art panels, occupation sites, campsites and granaries. Many more undocumented sites that exist within the monument are of significant scientific and historic value worthy of preservation for future study.

The monument is rich in human history. In addition to occupations by the Anasazi and Fremont cultures, the area has been used by modern tribal groups, including the Southern Paiute and Navajo. John Wesley Powell's expedition did initial mapping and scientific field work in the area in 1872. Early Mormon pioneers left many historic objects, including trails, inscriptions, ghost towns such as the Old Paria townsite, rock houses, and cowboy line camps, and built and traversed the renowned Hole-in-the-Rock Trail as part of their epic colonization efforts. Sixty miles of the Trail lie within the monument, as does Dance Hall Rock, used by intrepid Mormon pioneers and now a National Historic Site.

Spanning five life zones from low-lying desert to coniferous forest, with scarce and scattered water sources, the monument is an outstanding biological resource. Remoteness, limited travel corridors and low visitation have all helped to preserve intact the monument's important ecological values. The blending of warm and cold desert floras, along with the high number of endemic species, place this area in the heart of perhaps the richest floristic region in the Intermountain West. It contains an abundance of unique, isolated communities such as hanging gardens, tinajas, and rock crevice, canyon bottom, and dunal pocket communities, which have provided refugia for many ancient plant species for millennia. Geologic uplift with minimal deformation and subsequent downcutting by streams have exposed large expanses of a variety of geologic strata, each with unique physical and chemical characteristics. These strata are the parent material for a spectacular array of unusual and diverse soils that support many different vegetative communities and numerous types of endemic plants and their pollinators. This presents an extraordinary opportunity to study plant speciation and community dynamics independent of climatic variables. The monument contains an extraordinary number of areas of relict vegetation, many of which have existed since the Pleistocene, where natural processes continue unaltered by man. These include relict grasslands, of which No Mans Mesa is an outstanding example, and pinon-juniper communities containing trees up to 1,400 years old. As witnesses to the past, these relict areas establish a baseline against which to measure changes in community dynamics and biogeochemical cycles in areas impacted by human activity. Most of the ecological communities contained in the monument have low resistance to, and slow recovery from, disturbance. Fragile cryptobiotic crusts, themselves of significant biological interest, play a critical role throughout the monument, stabilizing the highly erodible desert soils and providing nutrients to plants. An abundance of packrat middens provides insight into the vegetation and climate of the past 25,000 years and furnishes context for studies of evolution and climate change. The wildlife of the monument is characterized by a diversity of species. The monument varies greatly in elevation and topography and is in a climatic zone where northern and southern habitat species intermingle. Mountain lion, bear, and desert bighorn sheep roam the monument. Over 200 species of birds, including bald eagles and peregrine falcons, are found within the area. Wildlife, including neotropical birds, concentrate around the Paria and Escalante Rivers and other riparian corridors within the monument.

Section 2 of the Act of June 8, 1906 (34 Stat. 225, 16 U.S.C. 431) authorizes the President, in his discretion, to declare by public proclamation historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest that are situated upon the lands owned or controlled by the Government of the United States to be national monuments, and to reserve as a part thereof parcels of land, the limits of which in all cases shall be confined to the smallest area compatible with the proper care and management of the objects to be protected.

NOW, THEREFORE, I WILLIAM J. CLINTON, President of the United States of America, by the authority vested in me by section 2 of the Act of June 8, 1906 (34 Stat. 225, 16 U.S.C. 431), do proclaim that there are hereby set apart and reserved as the Grand Staircase-Escalante National Monument, for the purpose of protecting the objects identified above, all lands and interests in lands owned or controlled by the United States within the boundaries of the area described on the document entitled "Grand Staircase-Escalante National Monument" attached to and forming a part of this

proclamation. The Federal land and interests in land reserved consist of approximately 1.7 million acres, which is the smallest area compatible with the proper care and management of the objects to be protected.

All Federal lands and interests in lands within the boundaries of this monument are hereby appropriated and withdrawn from entry, location, selection, sale, leasing, or other disposition under the public land laws, other than by exchange that furthers the protective purposes of the monument. Lands and interests in lands not owned by the United States shall by reserved as a part of the monument upon acquisition of title thereto by the United States.

The establishment of this monument is subject to valid existing rights.
Nothing in this proclamation shall be deemed to diminish the responsibility and authority of the State of Utah for management of fish and wildlife, including regulation of hunting and fishing, on Federal lands within the monument.

Nothing in this proclamation shall be deemed to affect existing permits or leases for, or levels of, livestock grazing on Federal lands within the monument; existing grazing uses shall continue to be governed by applicable laws and regulations other than this proclamation.

Nothing in this proclamation shall be deemed to revoke any existing withdrawal, reservation, or appropriation; however, the national monument shall be the dominant reservation.

The Secretary of the Interior shall manage the monument through the Bureau of Land Management, pursuant to applicable legal authorities, to implement the purposes of this proclamation. The Secretary of the Interior shall prepare, within 3 years of this date, a management plan for this monument, and shall promulgate such regulations for its management as he deems appropriate. This proclamation does not reserve water as a matter of Federal law. I direct the Secretary to address in the management plan the extent to which water is necessary for the proper care and management of the objects of this monument and the extent to which further action may be necessary pursuant to Federal or State law to assure the availability of water.

Warning is hereby given to all unauthorized persons not to appropriate, injure, destroy, or remove any feature of this monument and not to locate or settle upon any of the lands thereof.

IN WITNESS WHEREOF, I have hereunto set my hand this eighteenth day of September, in the year of our Lord nineteen hundred and ninety-six, and of the Independence of the United States of America the two hundred and twenty-first.

WILLIAM J. CLINTON

APPENDIX B: Summary of the coal resource of Kaiparowits Plateau and its value
Compiled by the Office of Energy and Resource Planning, October 9, 1996

Coal Resource of Kaiparowits Plateau

On the basis of a preliminary report recently released by the U.S. Geological Survey (USGS), there are 62.3 billion tons of in-place coal resource in Kaiparowits Plateau coal field. Of this resource USGS indicates that there are 30 billion tons of minable coal in various beds. According to the USGS report "These beds of coal are in areas where overburden is less than 3,000 feet thick and strata dip less than 12 . The coal tonnage is estimated for all beds of coal that are more than 3.5 feet thick, and coal tonnages in beds that are thicker than 14 feet thick are calculated as if they are only 14 feet thick." They also estimate that the total tonnage in beds of 3.5 feet to 7.4 feet is 15 billion tons. Using Utah Geological Survey figures, we estimate that 7.25 billion tons of coal are in seams of 3.5 feet to 6.0 feet which are considered uneconomical to mine in Utah.Removing this thin coal from the 30 billion tons estimated leaves 22.75 billion tons of minable coal. Applying a 50 percent recovery factor means the Kaiparowits Plateau contains an estimated 11.375 billion tons of recoverable coal.

Estimated Economic Value (bonus bid and royalty)

The potential value of the Kaiparowits Plateau coal is calculated on the basis of 11 cents per ton of minable coal (22 cents per recoverable) plus the royalty on the basis of eight percent of the value of the total recoverable coal, which is shown in table 1.

Table 1. Coal ownership and potential revenue.

DESCRIPTION	UNITS	TOTAL	FEDERAL	STATE	SITLA*
Coal Resources	Billion Tons	62.310(a)	57.200		4.800
Minable Coal	Billion Tons	22.750(a)	20.884		1.753
Leases held by Andalex	Billion Tons	0.880(a)	0.739		0.141
Unleased Minable Coal	Billion Tons	21.870(a)	20.145		1.612
Bonus Bid @11/ton	Million$	2,405.700(a)(b)	1,107.980 (c)	1,107.980 (c)	177.290
Recoverable Coal (Minable x 0.5)	Billion Tons	11.375	10.442		0.876
Royalty @ 8%& $19.50/ton	Million $	17,745.000(a)(b)	8,144.872(c)	8,144.872(c)	1,366.972
Total Bonus Bid+Royalty	Million $	20,150.700(a)(b)	9,252.852(c)	9,252.852(c)	1,544.262

*School and Institutional Trust Lands Administration.
(a)The total also includes a small amount on private land.
(b)This is a point-in-time estimate of the potential value of the coal reserve.
(c)The bonus bid and royalty receipts by federal government are shared on a 50-50 basis with the state of Utah, less a small percent for administration expense, which was 5.9 percent in 1995.

Potential Economic Benefit of Andalex's Smokey Hollow Mine Project

In Table 2, Andalex's mining plan for the Smokey Hollow mine, as described in the Governor's Office of Planning and Budget report dated October 1993, for the next 30 years and estimated income to each government entity is shown.

Table 2. Income derived from Andalex's mining activity.

DESCRIPTION	UNITS	TOTAL	FEDERAL	STATE	SITLA
Coal Mined*	Million Tons	72.001	60.481(a)		11.520(a)
Value of the Coal Mined (@ $19.50/ton)	Million $	1,404.014	1,179.372		224.642
Royalty Paid (@ 8% rate)	Million $	112.321	47.175	47.175	17.971
Annual Royalty Received	Million $	3.900	1.638	1.638	0.624

* Coal mined would be at 421,179 tons the first year plus 1,562,308 tons the second year plus 2,500,615 tons the following 28 years.

(a) Andalex requested to increase its mining area from 10,000 acres to 25,000 acres in 1995. Should this result in an increase in the amount of coal mined, royalty income to the federal and state government and SITLA would also increase.

APPENDIX C: Summary of coal resources on School and Institutional Trust Lands, Kaiparowits Plateau coal field, Kane and Garfield Counties.

County	Township	Range	Section	Acres	Thick (ft)	t/ac-ft	Tons	Depth Range (ft)	Note
Garfield	34S	2E	32	640	0	1800	0		?
Garfield	35S	1E	2	640	0	1800	0		?
Garfield	35S	1E	36	640	0	1800	0		?
Garfield	35S	2E	16	520	0	1800	0		?
Garfield	35S	2E	32	640	0	1800	0		?
Garfield	35S	2E	36	640	0	1800	0		?
Garfield	36S	1E	2	640	0	1800	0		?
Garfield	36S	1W	32	640	7.5	1800	8,640,000	2000-3000	sd
Garfield	36S	1W	36	640	30	1800	34,560,000	3000	
Garfield	36S	2E	2	640	60	1800	69,120,000	0-1000	?
Garfield	36S	2E	16	500	65	1800	58,500,000	0-1000	?
Garfield	36S	2E	32	640	70	1800	80,640,000	0-1000	?
Garfield	36S	2E	36	640	70	1800	80,640,000	1000-2000	*
Garfield	36S	2W	16	640	0	1800	0	0-1000	?
Garfield	36S	2W	36	640	0	1800	0	0-1000	?
Garfield	36S	3E	32	640	60	1800	69,120,000	1000	
Garfield	37S	1E	16	640	60	1800	69,120,000	3000+	
Garfield	37S	1E	32	640	40	1800	46,080,000	2000	sd
Garfield	37S	1E	36	640	70	1800	80,640,000	2000-3000	sd
Garfield	37S	1W	2	640	20	1800	23,040,000	3000	
Garfield	37S	1W	16	640	7.5	1800	8,640,000	1000-2000	
Garfield	37S	1W	36	640	20	1800	23,040,000	1000-	
Garfield	37S	2E	2	640	80	1800	92,160,000	1000-2000	*
Garfield	37S	2E	16	640	85	1800	97,920,000	1000	*
Garfield	37S	2E	32	640	65	1800	74,880,000	2000	*
Garfield	37S	2E	36	640	80	1800	92,160,000	1000	*
Garfield	37S	3E	16	640	40	1800	46,080,000	1000	*
Garfield	37S	3E	32	640	90	1800	103,680,000	0-1000	?
Garfield	37S	3E	36	640	0	1800	0	0-1000	?
Kane	38S	1E	2	480	55	1800	47,520,000	2000-3000	
Kane	38S	1E	16	640	40	1800	46,080,000	1000-2000	sd
Kane	38S	1E	32	320	20	1800	11,520,000	0-1000	sd
Kane	38S	1E	36	640	50	1800	57,600,000	3000	
Kane	38S	2E	2	480	65	1800	56,160,000	1000	*
Kane	38S	2E	16	640	65	1800	74,880,000	2000+	*
Kane	38S	2E	32	640	50	1800	57,600,000	3000+	
Kane	38S	2E	36	640	75	1800	86,400,000	2000	*
Kane	38S	3E	2	480	70	1800	60,480,000	0-1000	
Kane	38S	3E	16	640	90	1800	103,680,000	1000-	*
Kane	38S	3E	32	640	90	1800	103,680,000	1000	*
Kane	38S	3E	36	640	70	1800	80,640,000	1000	
Kane	38S	4E	16	640	35	1800	40,320,000	0-1000	*

County	Township	Range	Section	Acres	Thick (ft)	t/ac-ft	Tons	Depth Range	Note
Kane	38S	4E	36	640	30	1800	34,560,000	0-1000	
Kane	38S	5E	32	640	25	1800	28,800,000	0-1000	
Kane	39S	1E	2	640	40	1800	46,080,000	2000-3000	
Kane	39S	1E	16	640	20	1800	23,040,000	2000-3000	
Kane	39S	1E	32	640	10	1800	11,520,000	2000+	
Kane	39S	1E	36	640	40	1800	46,080,000	2000+	
Kane	39S	2E	2	640	65	1800	74,880,000	2000+	*
Kane	39S	2E	16	640	65	1800	74,880,000	2000-3000	
Kane	39S	2E	32	640	55	1800	63,360,000	2000+	
Kane	39S	2E	36	640	75	1800	86,400,000	2000+	
Kane	39S	3E	2	640	85	1800	97,920,000	1000+	
Kane	39S	3E	16	640	95	1800	109,440,000	2000-	*
Kane	39S	3E	32	640	75	1800	86,400,000	2000	*
Kane	39S	3E	36	640	110	1800	126,720,000	2000+	*
Kane	39S	4E	2	640	40	1800	46,080,000	0-1000	
Kane	39S	4E	16	640	50	1800	57,600,000	1000-	*
Kane	39S	4E	32	640	90	1800	103,680,000	1000-	*
Kane	39S	4E	36	640	40	1800	46,080,000	0-1000	*B
Kane	39S	5E	2	640	20	1800	23,040,000	0-1000	
Kane	39S	5E	16	640	15	1800	17,280,000	0-1000	
Kane	39S	5E	32	640	25	1800	28,800,000	0-1000	*
Kane	39S	5E	36	600	10	1800	10,800,000	0-1000	
Kane	40S	1E	2	640	30	1800	34,560,000	2000+	
Kane	40S	1E	16	640	20	1800	23,040,000	2000+	
Kane	40S	1E	32	640	15	1800	17,280,000	2000+	
Kane	40S	1E	36	640	15	1800	17,280,000	2000	
Kane	40S	2E	2	640	65	1800	74,880,000	2000-3000	
Kane	40S	2E	16	640	30	1800	34,560,000	2000-3000	
Kane	40S	2E	32	640	20	1800	23,040,000	2000	
Kane	40S	2E	36	640	30	1800	34,560,000	2000	
Kane	40S	3E	2	640	100	1800	115,200,000	1000-2000	*
Kane	40S	3E	16	640	50	1800	57,600,000	2000	*
Kane	40S	3E	32	640	35	1800	40,320,000	1000-2000	*
Kane	40S	3E	36	640	45	1800	51,840,000	1000-	*
Kane	40S	4E	2	320	50	1800	28,800,000	0-1000	*B
Kane	40S	4E	16	640	65	1800	74,880,000	1000-	*B
Kane	40S	4E	32	640	55	1800	63,360,000	0-1000	*
Kane	40S	4E	36	400	40	1800	28,800,000	0-1000	B
Kane	40S	5E	2	600	10	1800	10,800,000	0-1000	
Kane	40S	5E	16	640	15	1800	17,280,000	0-1000	*
Kane	40S	5E	32	640	25	1800	28,800,000	0-1000	*B
Kane	41S	1E	2	640	10	1800	11,520,000	1000	
Kane	41S	1E	16	640	5	1800	5,760,000	1000	
Kane	41S	2E	2	640	20	1800	23,040,000	2000	

County	Township	Range	Section	Acres	Thick (ft)	t/ac-ft	Tons	Depth Range	Note
Kane	41S	2E	36	640	10	1800	11,520,000	1000+	
Kane	41S	3E	2	640	40	1800	46,080,000	0-1000	*
Kane	41S	3E	16	640	30	1800	34,560,000	1000-	*
Kane	41S	3E	32	400	15	1800	10,800,000	1000-	
Kane	41S	3E	36	400	35	1800	25,200,000	0-1000	B
Kane	41S	4E	2	500	60	1800	54,000,000	0-1000	*B
Kane	41S	4E	16	640	45	1800	51,840,000	0-1000	*
Kane	41S	4E	32	300	40	1800	21,600,000	0-1000	B
Kane	41S	4E	36	600	30	1800	32,400,000	0-1000	B
Kane	41S	5E	16	640	30	1800	34,560,000	0-1000	B
Kane	42S	2E	2	640	5	1800	5,760,000	1000-	
Kane	42S	2E	36	600	5	1800	5,400,000	0-1000	
Kane	42S	3E	2	640	20	1800	23,040,000	0-1000	
Kane	42S	3E	16	640	5	1800	5,760,000	0-1000	
Kane	42S	3E	32	640	5	1800	5,760,000	0-1000	B
Kane	42S	3E	36	300	15	1800	8,100,000	0-1000	B
Kane	42S	4E	2	640	40	1800	46,080,000	0-1000	*B

Summary	**Tons in-place**
total resource	4,537,440,000
demonstrated	2,379,600,000
possible burn	463,860,000

? Denotes questionable value due to erosion.

* Denotes section generally within one mile of a data point (demonstrated).

'B' Denotes possible presence of burned coal seams

sd' Denotes steeply dipping coal beds inclined greater than 12°

APPENDIX D: Authorized Federal Oil and Gas Leases in the monument

Draft document from the Bureau of Land Management, November 7, 1996

Serial No.	Effective Date	Expiration Date	Lessee	Lease Acres
UTU-019375	11/01/56	HBP*	Citation O&G, et al.	888.80
UTU-019376	11/01/56	HBP	Citation O&G, e al.	2,551.42
UTU-019377	11/01/56	HBP	Citation O&G, et al.	2,378.60
UTU-019378	11/01/56	HBP	Citation O&G, e al.	1,600.00
UTU-0128442	03/01/64	HBP	Citation O&G, et al.	1,262.00
UTU-0128443	03/01/64	HBP	Citation O&G, e al.	471.71
UTU-7168	05/01/69	term suspended	Dean W. Rowell	640.00
UTU-1768-A	05/01/69	term suspended	Dean W. Rowell	680.00
UTU-7169	05/01/69	term suspended	Dean W. Rowell	320.00
UTU-7169-A	05/01/69	term suspended	Dean W. Rowell	1,480.00
UTU-7248	05/01/69	term suspended	Dean W. Rowell	100.00
UTU-9407	10/01/69	term suspended	Viking Expl. Inc.	1,905.00
UTU-32263	09/01/90	08/31/2000	William C. Kirkwood	650.00
UTU-57331	11/01/87	10/31/1997	John M. Beard, Trust	3,374.34
UTU-62108	11/01/87	10/31/1997	Robert C. Balsam, et al.	750.00
UTU-62109	11/01/87	10/31/1997	Robert C. Balsam, et al.	4,287.24
UTU-62273	11/01/87	10/31/1997	Robert C. Balsam, et al.	1,000.00
UTU-62275	11/01/87	10/31/1997	Rangeland Petro. Corp.	1,604.07
UTU-62603	11/01/87	10/31/1997	Robert C. Balsam, et al.	1,259.96
UTU-62616	11/01/87	10/31/1997	Robert C. Balsam	360.00
UTU-62869	02/01/88	01/31/1998	Bruce E. Gentry	80.00
UTU-62960	03/01/88	02/28/1998	Rangeland Petro. Corp.	640.00
UTU-63510	05/01/88	04/30/1998	Robert C. Balsam, et al.	1,083.80
UTU-66685	03/01/90	02/28/2000	Viking Expl. Inc., et al	640.00
UTU-67732	11/01/90	10/31/2000	Rangeland Petro. Corp.	960.00
UTU-67740	11/01/90	10/31/2000	Rangeland Petro. Corp.	480.00
UTU-67768	12/01/90	11/30/2000	Kidd Family Partshp.	2,840.00
UTU-68201	04/01/91	03/31/2001	Rangeland Petro. Corp.	1,271.00
UTU-68202	04/01/91	03/31/2001	Rangeland Petro. Corp.	839.25
UTU-68207	04/01/91	03/31/2001	Rangeland Petro. Corp.	320.00
UTU-68237	06/01/91	05/31/2001	Rangeland Petro. Corp.	3,258.80
UTU-68239	06/01/91	05/31/2001	Rangeland Petro. Corp.	6,340.23
UTU-68240	06/01/91	05/31/2001	Rangeland Petro. Corp.	4,640.04
UTU-68521	09/01/91	08/31/2001	Rangeland Petro. Corp.	640.00
UTU-68522	03/01/92	02/28/2002	Rangeland Petro. Corp.	678.50
UTU-68523	01/01/92	12/31/2001	Rangeland Petro. Corp.	3,360.00
UTU-68524	03/01/92	02/28/2002	Rangeland Petro. Corp.	3,754.00
UTU-68525	01/01/92	12/31/2001	Rangeland Petro. Corp.	6,723.00
UTU-68913	11/01/91	10/31/2001	Rangeland Petro. Corp.	943.00
UTU-68922	03/01/92	02/28/2002	Rangeland Petro. Corp.	894.89
UTU-68923	03/01/92	02/28/2002	Rangeland Petro. Corp.	1,040.00
UTU-68936	04/01/92	03/31/2002	Rangeland Petro. Corp.	640.00
UTU-68937	12/01/91	11/30/2001	L.H. Lueck, et. al.	239.47
UTU-69098	03/01/92	02/28/2002	Rangeland Petro. Corp.	1,590.56
UTU-69151	04/01/92	03/31/2002	Rangeland Petro. Corp.	320.00
UTU-69387	10/01/92	09/30/2002	Rangeland Petro. Corp.	790.00

UTU-69388	10/01/92	09/30/2002	Rangeland Petro. Corp.	3,711.29
UTU-69389	10/01/92	09/30/2002	Rangeland Petro. Corp.	5,595.17
UTU-69390	10/01/92	09/30/2002	Rangeland Petro. Corp.	4,060.00
UTU-69391	10/01/92	09/30/2002	Rangeland Petro. Corp.	5,599.00
UTU-69392	10/01/92	09/30/2002	Rangeland Petro. Corp.	2,880.00
UTU-69393	10/01/92	09/30/2002	Rangeland Petro. Corp.	4,320.00
UTU-69394	10/01/92	09/30/2002	Rangeland Petro. Corp.	2,760.00
UTU-69395	10/01/92	09/30/2002	Rangeland Petro. Corp.	1,878.25
UTU-69396	10/01/92	09/30/2002	Rangeland Petro. Corp.	564.00
UTU-69446	04/01/92	03/31/2002	Winona Oil Company	320.00
UTU-69483	10/01/92	09/30/2002	Rangeland Petro. Corp.	160.00
UTU-69598	05/01/92	04/30/2002	Rangeland Petro. Corp.	605.00
UTU-69602	06/01/92	05/31/2002	Vern K. Jones	159.44
UTU-69651	01/01/93	12/31/2002	Rangeland Petro. Corp.	1,442.76
UTU-69652	06/01/93	05/31/2003	Rangeland Petro. Corp.	520.00
UTU-69653	07/01/92	06/30/2002	Rangeland Petro. Corp.	6,992.00
UTU-69654	01/01/93	12/31/2002	Rangeland Petro. Corp.	1,583.00
UTU-69694	07/01/92	06/30/2002	Rangeland Petro. Corp.	960.83
UTU-69695	07/01/92	06/30/2002	Rangeland Petro. Corp.	711.50
UTU-69696	07/01/92	06/30/2002	Rangeland Petro. Corp.	2,289.25
UTU-69697	07/01/92	06/30/2002	Rangeland Petro. Corp.	640.00
UTU-70216	10/01/92	09/30/2002	Rangeland Petro. Corp.	480.00
UTU-70217	10/01/92	09/30/2002	Rangeland Petro. Corp.	320.00
UTU-70824	06/01/93	05/31/2003	Rangeland Petro. Corp.	2,745.00
UTU-70825	06/01/93	05/31/2003	Rangeland Petro. Corp.	9642.00
UTU-70867	01/01/93	12/31/2002	Rangeland Petro. Corp.	200.00
UTU-70868	01/01/93	12/31/2002	Rangeland Petro. Corp.	80.00
UTU-70869	01/01/93	12/31/2002	Irvin Kranzler	1,526.64
UTU-70870	01/01/93	12/31/2002	Rangeland Petro. Corp.	1,000.00
UTU-71379	04/01/93	03/31/2003	Rangeland Petro. Corp.	842.10
UTU-72001	06/01/93	05/31/2003	Vern K. Jones	354.00
UTU-72049	07/01/93	06/30/2003	Rangeland Petro. Corp.	25.00
UTU-72050	07/01/93	06/30/2003	Rangeland Petro. Corp.	479.46
UTU-72051	07/01/93	06/30/2003	Rangeland Petro. Corp.	440.00
UTU-72740	04/01/94	03/31/2004	Thomas Dorough	65.00
UTU-74352	05/01/96	04/30/2006	Vern K. Jones	2,637.67
UTU-74364	01/01/96	12/31/2005	Vern K. Jones	898.00
UTU-74365	02/01/96	01/31/2006	Vern K. Jones	2,379.00
UTU-74366	10/01/96	09/30/2006	Vern K. Jones	320.00
UTU-74897	03/01/96	02/28/2006	Ben Donegan	2,113.32
UTU-74899	02/01/96	01/31/2006	Ben Donegan	672.19
UTU-74964	01/01/96	12/31/2005	Rangeland Petro. Corp.	1,108.68
UTU-75210	10/01/96	09/30/2006	Mark S. Dolar	40.00
UTU-75211	10/01/96	09/30/2006	Vern K. Jones	1,079.40

*HBP - Held by Production - Upper Valley Unit Agreement

Total Leases: 90
Total Acreage: 141,068.63